Canada

PUTTING THE PIECES TOGETHER

Case Studies on the Deployment of Information Technology in Canada

ITAC
INFORMATION TECHNOLOGY ASSOCIATION OF CANADA

Industry, Science and Technology Canada
Industrie, Sciences et Technologie Canada

ISTC Industry, Science and Technology Canada

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PUTTING THE PIECES TOGETHER: CASE STUDIES ON THE DEPLOYMENT OF INFORMATION TECHNOLOGY

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FOREWORD

Information Technology (IT) is the fastest developing area of industrial and business activity throughout the Western world. Built around computers, telecommunications and software, this technology can be applied to virtually any business, and its potential for increasing productivity is immense. The opportunities presented by information technology, if properly applied, have a decisive influence on the competitiveness of industries and individual firms. However, implementing IT is a complex management challenge.

This report is about the introduction of IT in Canadian businesses. It examines the factors that affect the success of particular applications and brings into focus the knowledge and experience of a variety of small- and medium-sized companies as they implement information technology systems.

The report does not attempt to lay down sets of rules about the superiority of any particular technology or the kind of management decisions that will ensure success. Rather, the purpose of the report is to draw attention to a number of important factors to be considered in adopting new technology. It is hoped that readers, especially managers, will find much in this report to stimulate their thinking or be encouraged to explore new approaches.

It is vitally important that Canadian industry exploit the opportunities presented by the effective application of IT. The economic prosperity of the country depends on the success with which we manufacture products and provide services, and this success is increasingly equated with the competitive use of technology in all industries. This report can go some way toward doing this and help set the scene for Canadian industry to take greater advantage of IT.

The sponsors of this report wish to express their appreciation to Messrs. D. Little and B. Mascall of Woods Gordon who carried out the case studies and wrote this report.

Industry, Science and Technology Canada

Information Technology Association of Canada

Table of Contents

CASE STUDY OVERVIEW

PAGE

1. INTRODUCTION 1

2. METHODOLOGY 2

3. SUMMARY 4

- 3.1 Role of the Champion 8
- 3.2 Cost Avoidance and Cost-Benefit Analysis 10
- 3.3 Fit with the Corporate Plan 12
- 3.4 Supplier Competence 14
- 3.5 Clearly Set Objectives 16
- 3.6 Evaluation of User Needs 17
- 3.7 External Pressure 19
- 3.8 Flexibility 20
- 3.9 Identification of the Opportunity 21
- 3.10 Previous Information Technology (IT) Experience 22
- 3.11 Non-Deployment 23

4. COMMENTARY 23

CASE STUDIES

Company	Line of Business	System Implemented	
A	Wholesale	Order Entry	35
B	Forest Products	Programmable Logic Controllers	46
C	Food/Restaurant	Telephone Ordering System	56
D	Forest Products	A Quality Control System	64
E	Engineering Consulting	Engineering Design Systems	70
F	Retail	Inventory/Purchasing Control System	80
G	Food Processing	Process Management System	89
H	Finance	Financial Transactions System	97
J	Food Processing	Payroll and Inventory Control	106
K	Aerospace	Micro-graphic System	113
L	Mining	Mine Modelling System	120
M	Auto Parts	Production Control System	129
N	Forest Products	Human Resources System	135
P	Auto Parts	Inventory Management System	144
Q	Auto Parts	Robotics	153
S	Retail/Wholesale	Non-Deployment	160
T	Retail	Non-Deployment	164

Bibliography

Case Study Overview

1. Introduction

This study was commissioned jointly by Industry, Science and Technology Canada (ISTC) and the Information Technology Association of Canada (ITAC) in January, 1988. The focus of this work is to find representative examples of two things: factors leading to successful deployment of information technology and factors impeding successful deployment. Both ISTC and ITAC are interested in increasing use of information technology in companies across the country and wish to develop a document which might encourage, through example, other implementations. They want to identify any barriers to successful implementation so that both suppliers and future users may learn to overcome these impediments.

This work focuses on the process of technology deployment. It is not concerned with assessing the technology itself with nor with the technological merits of one system over another. The research examines the process that a company has to go through to get a system up and running and, by comparing this process for 15 companies, attempts to identify common elements.

The project sponsors commissioned Woods Gordon, a Canadian management consulting firm, to undertake the research and reporting of this project. The summary section relays the findings in a direct manner and the commentary section presents the opinions of Woods Gordon and a panel of industry experts as they apply to the findings of the case studies. The process followed throughout the study has been highly interactive with a Steering Committee representing both sponsors having input at every step of the way.

2. Methodology

The research for this work was carried out between January and June, 1988. Through discussions with client groups, a list of industry sectors was developed from which each of the 15 cases was drawn. These industries provided both interesting examples of technology deployment as well as potential for considerable further deployment. These industries are not felt to be leaders in the deployment of information technology — in fact, part of the rationale for selecting them was to see if some of the reasons for this lack of activity could be identified. Relevant examples of successful deployment may also be used to encourage companies in these industries to take more initiative in the deployment of information technology. The industrial distribution of the case studies is presented in the table which follows.

Industries	Number of Cases
Manufacturing	
Food and Beverage	3
Automotive Parts	3
Aerospace	1
Resources	
Forest Products	3
Mining	1
Services	
Retail Trade	1
Wholesale Trade	1
Financial Services	1
Consulting Engineers	1
Total	15 Cases

Small- to medium-sized companies were selected to provide examples that would be readily applicable to a significant number of Canadian companies. There is no universal definition of small- and medium-sized companies, so each industry was taken individually and the selection was subjective according to the norms of that

industry. They were drawn from across the country and represent a diversity of experience.

The companies selected were not intended to provide a comprehensive sample of the entire country, but rather, to give interesting examples of what some companies have done and what could be done by other companies in Canada. Because the selection procedure involved finding companies willing to talk about their experience, we were unlikely to have any cases that were outright failures. Similarly, any evidence of weakness that may exist in certain implementations was likely minimized by those involved. All the cases we describe here are considered by the companies to be successes — providing a bias in the sample that we would not assume to be representative of the population.

The research was undertaken by personal interview with the companies and, where possible, with the suppliers of systems that had been installed. In addition, there were two 'non-deployment' cases, examples of companies that had chosen not to invest in information technology systems. These provided a counterbalance to the reasoning behind the deployment cases. There was a concern on the part of both sponsors of this work that Canada was lagging behind the rest of the world in the implementation of information technology; it was hoped that the examination of cases of companies that had not installed systems might identify some barriers to deployment.

An interview guide was developed to give focus to the research with help of the Steering Committee. An 'Expert Panel' was formed to work with the consultants and Steering Committee on the identification of the issues that were most important in the selection and implementation of information technology systems. These individuals — Gary Corlett of Noranda Inc., Hans Wobbe of the Royal Trust Company and William Hutchison of William G. Hutchison & Associates — all had experience in the process of installing technology systems, either as consultants or as users. The input of this group was important in helping to focus attention in what is potentially a very broad field. They helped to identify key issues to be explored in

the interviews and ensured that time was not being spent exploring less important issues.

Upon completing the initial draft and analysis, a Delphi panel was selected and the report was distributed to the 16 panel members for their comments, observations and opinions. These opinions were incorporated into the draft report, which was then re-distributed to the panel members for a second and final round of commentary. The final report incorporates these two rounds of comments from the Delphi panel. Panel members were Hans Wobbe of Royal Trust, Dr. Diane Wilson of the Massachusetts Institute of Technology, Graeme Hughes and Bob Crow of ITAC, Ernest Ball of Unisys Canada, Brian Coll of Digital Equipment of Canada, Peter Gorrell and Bob Logan of IBM Canada, John O'Neill of 3M, Kingsley Allaster of D.H. Howden, Tony Hook of Butler Metal Products and four members from ISTC — Ron Watkins, Andre Dubois, Bernard Dreyer and Jane Billings.

The interviews with each company were undertaken on a confidential basis. Neither the name of the company being profiled nor the name of the technology suppliers are used.

Some minor details of the description have been obscured in some instances to protect the anonymity of the companies. This focuses the attention of the reader on the issues, rather than on the specifics of one company or one technology.

3. Summary

Before summarizing the commonalities, success factors and other findings of the 15 case studies, a brief description of the characteristics of the profiled firms is in order. The case studies covered a size range extending from small companies of $1 million in annual revenue and 10 employees, to larger firms with $600 million in annual revenue and 3000 employees. The firms are in the small- to mid-size range for each industry. For example, the auto parts, mining, aerospace and forest products firms, although larger than the rest of the sample, generally rest in the

middle of the size range for their industries. Most of the cases dealt with private, Canadian-owned firms. Three of the firms were subsidiaries of foreign parents.

Four-fifths of the firms had previous experience with some form of information technology. Some of this experience was simply in the form of an employee or two 'playing around' with a personal computer. About one-third of the firms had formal technology plans; these companies also had significant levels of prior computer expertise. Some of the larger firms were of sufficient scale to have a separate systems department.

As the size of firm varied, so too did the scale of implementation. The systems profiled in the cases ranged in size from a $6000 or $7000 personal computer or programmable logic controller, to a $2.4 million implementation with 200 terminals. The systems addressed the following applications: welding robotics, order entry, quality control, modelling and designing, purchasing and inventory control, process management, payroll management, databases and human resource management.

With two exceptions, all of the cases involved an individual who championed the project — initiating it and guiding it through various obstacles. In three of the cases this individual owned the firm. Three other champions were general managers of the plants in question, while two were at the vice-president level in the finance area. Aside from one vice-president of human resources, who championed an implementation related to human resources, the remaining four were from the engineering divisions of the firms. Very few of the champions had any background in the systems area, suggesting that extensive expertise in information technology is not always a prerequisite to being a successful champion. In most instances, however, the champion was in regular contact with, and had confidence in, assistants with technical expertise.

With that as a profile of the companies discussed in this work, we now turn to a summary of the information contained in the case studies that follow. This discussion looks at the elements that are common to many of the cases and draws some conclusions about those that are required for successful information technology

deployment. The findings should be interpreted keeping in mind the size and other characteristics of the case subjects. For example, one may expect very large deployments to have very different factors and criteria for success from small first deployments.

When each case was completed, we prepared a list of issues that were important in that case. At the end of the process, we pulled together all these lists and looked for the common elements. The resulting table is presented on the opposite page. There is a danger in providing a statistical summary for what is essentially not a statistical exercise. The cases provide interesting examples of the process and problems encountered during the deployment. The summary table provides a general overview of some of the factors that appeared frequently. It is likely that a different definition of success factors would lead to some adjustments in the rankings. The main purpose of the ratings and summary table is to provide focus to the following analysis.

Each of the issues was given a rating by the consultant according to its importance in that deployment. This is the relative importance that individuals we interviewed placed on factors that influenced the success of their deployment. It may be that the importance of a factor was felt in only one phase of the deployment process — such as the system selection — but its importance was felt to be key in the overall success of the implementation. The total of all the ratings is given in the column at the right. We discuss the seven most important of these in the sections that follow; we also include a discussion of several factors that have conspicuously low scores.

The research methodology has produced a sample of companies that consider themselves to be successful. This makes it difficult to say with confidence which factors contributed most to that success. Following the summary section, which presents the results of the research, we provide a commentary on this information with somewhat more subjective comments on the experience reported here.

Relative Importance of Implementation Success Factors

(0=Unimportant or Not Relevant, 1=Minor Importance, 2=Important, 3=Major Importance)

Factors	Company															
	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	Total
Role of the Champion	3	2	3	2	2	3	3	1	3	1	3	2	3	3	2	36
Cost Avoidance	1	3	2	1	2	2	3	2	3	3	2	3	1	2	2	32
Fit with Corporate Plan	3	2	3	3	2	3	1	1	1	1	1	2	2	2	3	30
Supplier Competence	3	2	1	2	2	3	2	3	1	0	2	1	2	3	3	30
Clearly Set Objectives	1	1	3	3	3	1	1	2	1	3	2	2	2	2	2	29
Evaluation of User Needs	2	1	1	1	3	3	1	3	1	3	2	2	1	3	1	28
External Pressure	0	1	3	1	3	1	2	3	1	2	0	2	1	3	3	26
Advance Planning	2	2	1	2	2	0	2	2	0	2	1	2	2	2	2	24
Role of Training	2	1	3	1	2	2	1	2	1	0	1	3	1	3	1	24
Involvement of Users	0	1	1	0	3	2	0	3	0	2	2	2	1	3	1	21
Cost-Benefit Analysis	1	1	3	2	0	0	1	1	0	3	1	2	1	1	3	20
System Compatibility	2	0	0	2	2	1	1	2	0	1	1	1	1	2	2	18
Flexibility of Plan	0	2	0	0	1	3	0	2	0	1	1	2	2	2	1	17
Previous IT Experience	2	0	0	2	3	0	1	1	0	3	2	1	1	0	1	17

Note: The 'importance' listed in this table is a reflection of the value placed on these factors by the individuals interviewed within each company.

3.1 Role of the 'Champion'

In almost every case, there was an individual who was responsible for the decision to invest in a new system, and who was responsible to a large extent for the subsequent selection and implementation. For most cases this individual was crucial to the success of the deployment; without this person, the system probably would not have been purchased. There were only two cases that did not find that a 'champion' had some importance in deployment. These two were also successes, but they had clearly defined procedures to assist in decision making and implementation planning.

The concept of a champion in Information Technology (IT) deployment has been the subject of much discussion in trade and academic publications. In these cases we have observed the presence of an individual who has been instrumental in making the deployment happen. The champion is someone who does not take 'no' for an answer, and who does take whatever steps are necessary to keep the idea moving towards implementation. This is very similar to the definition of champion provided by Bob Burgleman, in his book *Inside Corporate Innovation.* Where we differ from Mr. Burgleman is in the technical background of the champion. Although his work suggests that the champion is traditionally an engineer or designer, we were struck by the number of individuals in our cases who were responsible for bringing these deployments into being, without having strong technical training or experience. These are individuals described by Mr. Burgleman as "organizational champions." Input from our Delphi panel suggests that the organizational champions "must have an equally talented person with the necessary technical skills to work with, be that person an employee or a supplier. Information Technology must not be sold to industry as not requiring technical skills."

In most cases this champion was the chief executive of the company, or senior manager drawn from one of the operating divisions or from administrative functions such as finance or data processing. This was significant in that the individual had a level of responsibility that allowed him (there were no female champions in our sample cases), to make decisions and act on them without having to justify every

step with senior management. The position also meant that other people in the organization would take this person seriously and would work to ensure the success of the deployment. There were no serious 'blockers' to projects where the senior executive was the 'champion', in the way that there were in cases where the 'champion' was a more junior manager.

Many people in this sample felt that the decision to invest in a new system was difficult to cost justify, or to approach in the same way as any other business decision. Such a decision is easy to shoot down. It takes a courageous executive to stand up and say, "Do it," yet this is often what a project most requires. Most champions believed that their deployments needed 'a leap of faith' to get started. For this faith to be shared by the rest of the company, it must start at a sufficiently high level in the organization.

There is no clear path by which the champion emerges. The individual is generally self-appointed, having some exposure to information technology but not necessarily any training in the field. The only element the champions we met have in common is their senior positions within their companies. The extent and type of involvement of the champions at different stages of the project varies from firm to firm and is based on industry differences, organizational structure and the need that the project addresses.

In the cases where the champion was most important, other issues — such as cost-benefit analysis and evaluation of user needs — seem to be less relevant. It appeared that the influence of the committed senior manager allowed staff to concentrate on 'how to' issues, rather than on justification for the system during the initial decision. The senior manager's influence may also have inhibited some people from knocking or questioning the system. It is not possible to attribute causality to this relationship; it is not clear whether the presence of a champion makes evaluation and analysis unnecessary, or whether the absence of a champion makes these other issues more important.

Conclusions:

1. The presence of a senior executive to champion the deployment of a system is an important factor in the decision-making process.
2. A committed senior executive will allow the streamlining of the decision-making process and allow the focusing of attention on planning and implementation issues. This process will also foster team spirit among those who are responsible for the selection and implementation.

3.2 Cost Avoidance and Cost-Benefit Analysis

The most commonly quoted reason for investing in a new technology system was some kind of cost saving. The types of cost savings included reducing staff costs, being able to grow without increasing staff, cutting staff time on repetitive clerical tasks and increasing the speed at which some jobs are done, thus freeing staff for other tasks. All the 'champions' believed that the systems they implemented were of benefit to their companies.

It is interesting to compare the importance of this issue in these companies with their ranking of cost-benefit analysis. Cost-benefit analysis received one of the lowest rankings of any of the issues listed. Yet one might expect that those companies that thought cost avoidance was a primary objective would want to try to quantify the cost savings. In fact, most felt that the savings were too difficult to quantify in advance but that any improvement in the costs would provide a payoff for the investment.

The differentiation between these two issues reflects the approach to the quantification of the benefit. There is a considerable range in the approaches to quantification in these cases, from 'best guesses' to formal analyses. In all the cases the benefits are believed to be there, but the effort put into evaluating the benefits varies from company to company.

Some companies did a 'back of the envelope' calculation which suggested that if the system saved a certain amount, the net gain to the company might be significant. The managers, however, did not consider this to be true cost-benefit analysis. Their perception was that cost-benefit analysis required a rigorous approach which was impractical for these systems. Many of the benefits the managers identified were not hard quantifiable benefits, but were seen as 'soft' benefits, such as improved quality, which the managers believed did not lend themselves to formal analysis. As one of our champions commented, "In many cases, the 'analysis' becomes an end in itself. Many projects have ended up on the cutting room floor because of overemphasis on those factors that ultimately preclude action."

About half of the companies in our sample performed some kind of cost-benefit analysis. Only three companies undertook this rigorously, and each of these had established evaluation procedures for all capital expenditures. The other companies felt that cost-benefit analysis had some importance and did some rough calculations, but they did not consider these to be very accurate. Although it was possible to quantify most of the costs of a new system, many of the people we interviewed found it almost impossible to evaluate and quantify the benefits they expected. The benefits — such as better quality of product, better working conditions or a more efficient operation — were considered intrinsically good, but did not translate directly into increased sales or lower costs. Some companies may find the difficulty of quantifying these benefits an insurmountable obstacle to the approval of an implementation. The companies covered in these cases were able to overcome this obstacle and 'take the plunge'. Companies also mentioned an aversion to bureaucracy and paperwork as reasons for not requiring formal cost-benefit analyses.

Most of the systems described in these cases are small. It may be that the size of these deployments was such that a rigorous approach to analysis was not thought to be necessary. Certainly these cases show that it is possible to proceed without a detailed cost-benefit analysis.

If cost avoidance were the justification, most proposers of a new system thought that it would most likely get approval. It was not always clear, in the cases where some

kind of cost-benefit analysis was not undertaken, exactly what the savings would be. For instance, it might make good sense to reduce the workload of an employee by putting in a new system, yet there was not always a need for that individual to do something else.

Most of these cases did not involve any audit of the benefits afterward. Some companies reported improved sales since the implementation and felt that this was in some part a result of the deployment, but little had been done to quantify the benefits actually received after the installation. In many cases, the companies were quite small and did not have the resources, the capability or the inclination to conduct formal cost-benefit analyses or audits on projects intuitively felt to be beneficial to the firm.

Conclusions:

1. An argument for the cost savings (as opposed to more intangible benefits) is considered to be an important factor in getting approval for a new technology installation, although some of those savings may not be strictly quantified.
2. While some companies demand a rigorous cost-benefit analysis, others believe that cost savings may be clear enough without quantification to warrant approval to proceed with a deployment.

3.3 Fit with the Corporate Plan

The companies in these cases range from those whose corporate plan is simply to sell more than the previous year, to those who have detailed strategic plans for the ensuing 5 to 10 years. About half of the companies covered in these cases have full-time data processing staff, yet few of the companies made technology planning an explicit part of the corporate strategy. Those who did have a 'technology plan' were able to undertake the larger installations considered in this project. The existence of a technology plan reflects the importance that a company places on the role of technology in the work of the company. If a plan exists, the company has already recognized the benefits that technology can bring to the company, and the

company is more likely to make substantial investments in this area. Companies that do not make such plans tend to keep their investment level low, and plan implementations in manageable phases to make the immediate investment smaller.

Certain profiled cases clearly have organizational and operating policies that subordinate the role played by their engineering and technology groups. Because these groups may not directly impact on revenues in the short-term, their input has been taken much more lightly than that of the operations and finance groups. In these instances, the deployment of technology has been irregular and forced upon the company by external forces, rather than proactively planned, selected and managed by the company.

The fit with a corporate plan reflects the commitment of a senior executive to technology within the company. The senior position of the individual appears important. Whereas junior managers are task oriented, the senior executive has a broader perspective and is concerned with systems that have a long-term impact on the company as a whole.

Conclusions:

1. A 'technology plan' developed in conjunction with the company's strategic plan is not necessarily a prerequisite for a successful deployment.
2. Companies that have a formal technology plan are more likely to undertake larger investments that have a more lasting impact on the organization. They are also more likely to see the strategic importance of a system, which may help in the decision-making process, even if cost-benefit analysis is not attempted.
3. The lack of clout of the engineering and systems groups within some organizations may result in firms having technological changes thrust upon them without adequate planning.

3.4 Supplier Competence

Suppliers have been instrumental in introducing to these companies the concept of some of the technologies. Many of the 'champions' initiated action on a new system once they had seen the technology at work at a trade show or had discussed what could be done with a supplier. In almost all cases, the confidence the companies had in their suppliers encouraged them to proceed and contributed significantly to their satisfaction in the resulting deployment.

This initial contact was important. Few of the 'champions' knew in advance exactly what equipment they wanted and needed guidance from the supplier on the most appropriate technology. In two of the cases, the users had to work with the suppliers to develop the technology because the application had not been tried before. This increased the risk to the company installing the systems and required considerable support from the vendor. The fact that this support was forthcoming in both these cases of system development may have been instrumental in the companies' proceeding with the deployment in the first place.

In as many as five of the profiled cases, the competence and knowledge of the vendor-designer was felt to be the most important factor behind the success of the implementation. The 'champion', in these cases, may not have been highly computer-literate, nor even particularly inclined to become so. The existence of a system designer, who is knowledgeable in both the capabilities of the system and the requirements of the client, is clearly very important in these instances.

Related to this factor is the necessity to establish trust and confidence between the vendor and the buyer. In many of the cases, the company had known the vendor-designer prior to the implementation, either in a work or social context. The resulting trust allowed the company to proceed with the implementation with added conviction. The possibility of unexpected costs, work delays and impatience on behalf of the designer was reduced by the establishment of some form of long-term relationship prior to implementation. This requirement becomes more important in companies where computer literacy and experience is not high, and where the firm

would presumably be at the mercy of the system designer. We profiled one instance where an adequate level of trust had not been established and supplier support subsequent to the implementation was not forthcoming. This left the company with a poor assessment of the technology, an assessment coloured by the firm's poor opinion of the supplier, rather than by any particular shortcomings of the system.

In our non-deployment cases, lack of confidence in the supplier and in the technology were the reasons for the companies' not proceeding. In these cases, the individuals were concerned that they had been unable to find a supplier to meet their needs. It was not clear whether they had unreal expectations from the technology. It was apparent, however, that the suppliers were unable to get them to define their needs in terms of the technology that was available. These managers needed a supplier to educate them on the systems that could help them. The confidence that would have been generated from such an approach might have allowed the managers to implement a system.

Our discussions with vendors and 'champions' have also indicated that, even in instances involving competent designers, there is often a weakness in the areas of system documentation and follow-up training. Certain systems professionals are more patient and sensitive than others. The most successful implementations occurred when the firm made an attempt to gauge the vendor's cooperativeness prior to becoming committed to the purchase.

Conclusions:

1. The existence of a supplier or outside consultant with knowledge of the system's capabilities and of the firm's requirements is an important success factor that arose in many instances.
2. The establishing of a level of trust and confidence between the supplier and the champion is a requirement that arose on various occasions, particularly when the champion was not computer literate.

3.5 Clearly Set Objectives

There were a number of companies considered in this work that did not set clear objectives for the implementation of information technology. Many companies had preconceived ideas about the information technology they wanted and spent little time or effort defining the problem to be solved.

This suggests that, for many of the managers of the implementations examined here, the objectives were implicit rather than explicit. This did not prevent the deployment from proceeding or benefits from accruing, but made it difficult to assess the success of the project. In objective terms, this might be considered a problem, but the management in these cases has not felt it to be a serious concern. They are confident that their implementation has been a success, without objective measures of the value of that success. As one of our panel members noted, the "subsequent impression of a successful implementation may be related more to the fact that an existing system was changed than to the fact that it was improved. Hawthorne effects have been understood for some time, in spite of the fact that they generally cannot be quantified."

This has required a 'leap of faith' from the management and staff that the deployment was worth the effort spent on it. Those cases that were unable to identify or evaluate the objectives of the installation were as satisfied as those that had done such an evaluation.

The objectives which were mentioned appear to be general (such as those discussed above under the heading cost avoidance), covering improvements in quality, speed, efficiency and cost performance. Few of the companies set up mechanisms to measure these improvements. Most managers commented that they were sufficiently in tune with their businesses to tell whether the improvement took place or not. Since these are small- to medium-sized companies, this may be sufficient.

The lack of clearly set objectives was also characteristic of firms that had not anticipated the operational changes necessary to accommodate the new system. Generally, those firms that focused on the technology rather than on the technology's function, encountered difficulties and delays in preparing their firm for life after the implementation.

Conclusions:

1. The lack of clearly set objectives does not preclude successful deployment but does make it difficult to quantify the value of the benefits to the company afterward.
2. While clear objectives provide mechanisms for evaluating performance of a new system, management in smaller companies believes that they have been able to judge success without making these criteria explicit. Without these objectives, it is not always clear what is meant by success.

3.6 Evaluation of User Needs

Almost all the companies profiled here stated that it was important to evaluate the specific needs of users within the firm before selecting a system. However, more than half of the senior managers involved in planning a new deployment felt sufficiently knowledgeable about user needs to proceed without actually speaking to the users. Only a few of the cases described a process of consultation with the users before selecting and installing a system.

User needs are likely to fall into a variety of categories, ranging from those that are desirable to those that are necessities. Two or three of the companies profiled had explicit processes to evaluate user needs; these processes were based on a corporate technology wish list. Aside from these cases, the companies in our sample had no explicit process for ranking user needs. It is likely that there was an implicit process to evaluate whether these needs warranted some investment, but there is no evidence that all needs were considered in the decision-making process.

It is probably true that the senior managers responsible for the deployment were indeed quite knowledgeable about user needs. Part of the process of ascertaining user needs, however, is to bring the users into the process and allow them to 'buy into' the system. The system may be configured to meet users' needs, but if they have not had an opportunity to have input into the process, they may not want to participate in the result. Those companies that involved users at the early stages of planning had an easier implementation period and avoided potential blockers who might have threatened the success of the deployment.

More effort was directed toward the users during the implementation phase than in the planning phase. However, the implementation may take longer and be more difficult if the users have not been previously involved in discussions about the system. In one of the cases, the implementation of part of the system was abandoned because the users were not interested in getting involved and did not appreciate the benefits to them of putting up with the change. If these users had been involved in defining the system, then they may have been in a better position to judge the value of the system for them. It appears from these cases that user consultation is more useful as a selling technique than as a factor that drives the deployment of new technology. This may be a result of the size of the companies in our sample. Larger companies might find that user consultation may be more important to the decision-making process.

Although not a startling revelation, it is perhaps worthwhile noting that those systems that required a high degree of user involvement and skill had more interaction during the planning and implementation process than was the case in the simple systems. In projects that were hardware dominated, with user involvement perhaps limited to the pushing of a few buttons, the 'champion' displayed more independence in handling the purchase decision, system selection and implementation aspects. In those projects that involved extensive system design to replace manual functions, the users were generally brought into the picture at the earliest possible occasion, such as during the decision and selection phases.

Conclusions:

1. Users need to be given the opportunity to 'buy into' a new system.
2. The involvement of users early in the deployment process will help to facilitate a smooth implementation.
3. The lack of user involvement early on in the planning stages of a deployment does not preclude success, providing that the system does not demand a high degree of user involvement once it is up and running.

3.7 External Pressure

Competitive pressure was a motivating factor in all of the profiled cases. In most instances, competitive pressure is implicit rather than explicit. The companies believed that the new system would improve their speed of service, the quality of their production or the cost of production. Each of these improvements would put the company into a stronger competitive position but was not driven by the example of others. A few of the companies were more explicit about the influence of competitors: "We were confident in our deployment because of the success others had with similar deployments" or, "The trend amongst our customers was toward tighter specifications."

Other forms of external pressure were more direct and had a strong influence on the deployments. The activities of customers and suppliers also had an impact on the systems installed — although these influences affected the timing of the implementation rather than the decision itself. For example, we profiled two instances where the inability of the supplier to continue the contract forced a company to accelerate the implementation of a system that it had considered purchasing at some point in the future.

In these two instances, the pending failure of an outside provider of services forced the companies to acquire the in-house capability to provide these services. In each of these examples, the companies were quite technologically competent. This may indicate that even the most diligent planning and evaluation will occasionally be

confronted by unforeseen developments. It is noteworthy that in both of these instances, the companies, in retrospect, wondered why they had not provided the service in-house all along.

Conclusions:

1. External pressure can provide the added push needed to decide on an implementation that should proceed in any event.
2. Competitive pressure is a factor, though often implicit, behind virtually all our deployments.

3.8 Flexibility

The timing of the installation was also a factor in the success of some of the cases. All of the larger projects had broken the system into modules which were implemented over time in manageable portions. The smaller installations often became parts of a larger system following the successful implementation. It appears that implementations need to be approached in units small enough to manage, so that a large system will be slowly implemented and therefore grow with the company. It also allows for abortion of the project, if this becomes necessary, without having to complete the deployment. This approach was used consistently across all our cases, regardless of the size of company, the existence of a technology plan or the experience the company had in previous deployments. The single exception in our sample is the Greenfield site where a full system was installed for the opening of the plant.

Related to this system flexibility is the observation that the future path of individual companies was revealed as a very difficult matter to predict. Certain companies felt that an important factor for long-term success of deployment was the maintaining of a flexible and compatible system strategy. The acquisition of highly technical and tailored systems, although at times unavoidable, may prove to be costly if future developments force the firm to acquire other systems that cannot be integrated to the tailored system.

Most of the firms had adopted some type of implementation plan early in the life of the project. Not surprisingly, most also adjusted the plan on many occasions in response to unforeseen developments. Those 'champions' and systems designers with whom we spoke indicated that companies generally tend to significantly underestimate the amount of time and employee effort associated with most implementations.

The most successful implementations, therefore, manage to adapt to these circumstances by anticipating delays, having fall-back plans and having a flexible 'champion' willing to adapt to various obstacles.

Conclusions:

1. Many firms adopted generic approaches to their system selection because of a desire to retain maximum flexibility in future systems-related decisions.
2. Although many firms adopted some form of implementation plan, these plans were altered and delayed on many occasions. Many companies indicated that they had underestimated the time and effort that was required for the system implementation.

3.9 Identification of the Opportunity

The source of the initial idea varied from case to case. Two of the companies decided to conduct in-house a service that was formerly offered by an outside agency. In three of the companies, the implementation started as a result of hiring a manager who brought system-related ideas or expertise from a previous workplace. In addition to these three, two other firms gained initial insight through observing the progress of their direct competitors. Two of the firms received, at least in part, the initial idea from attending a trade or technology show. The presence of an informed personal contact or vendor was also a strong factor behind the initial idea of three of the implementations in the profiled cases. Finally, five of the projects were started simply by soliciting internal suggestions and conducting a planning process within the

firms themselves. A couple of the implementations appear to have been initiated by more than one of these methods.

It is interesting to observe that one-fifth of the cases involved with firms that were forced into implementations. Reacting to unforeseen events is not an uncommon requirement in the business world, but the influence of time constraints and precipitous action has a great impact on an event that is already difficult and fraught with anxiety.

3.10 Previous Information Technology (IT) Experience

Few companies profiled in this work had much experience or even knowledge of information technology. Three companies in our sample had no experience with any information technology before this implementation. Another four companies had small specialized systems installed, such as accounting systems, but the management outside this functional area had no contact with the technology and a very low level of computer literacy. Only half of the companies we interviewed had staff dedicated to some kind of data processing or information technology (IT) function. For the rest of the companies, their level of investment was not sufficient to warrant full-time staff.

It is clear from the research that those firms with previous IT experience approached their implementations in ways significantly different from those who were planning their first deployment. They were generally more ambitious in their plans, looking for systems that were likely to have a greater impact on the company as a whole. They were also likely to have attempted a more formal evaluation process in deciding on the deployment. This may be a function of several factors: the larger investment required for these systems, the presence of IT departments in these companies, and the need to integrate the new system with established IT operations, as well as the increased level of experience in the company.

It is difficult to see whether education or experience is the issue. It may be that a company has to go through the experience of one or two modest deployments before management has the courage to attempt substantial implementations and that better knowledge of IT (without that experience), is not enough.

3.11 Non-Deployment

Our two non-deployment cases — instances of a company's deciding against an investment in technology — provide interesting examples of the barriers small companies encounter. The sample is too small for us to make generalizations about the entire population, but two features emerge that are relevant to the experience of the other cases we have seen.

In both of these cases, the senior executives required considerable assurances that the systems they were to buy did in fact execute the applications they were supposed to in the manner specified. They anticipated having problems over a considerable period and wanted the support of the vendor throughout. This concern reflects their inexperience with technology but reinforces the need for sensitivity on the part of the vendor in dealing with such customers.

Neither of these managers undertook any cost-benefit analysis of their situations and had no idea of the value a system would have for their operations. This was primarily a result of their inability to identify a methodology for quantifying the benefits. Conducting a cost-benefit analysis would probably have assisted both these managers in setting reasonable price horizons and perhaps given them more confidence in the selection process.

4. Commentary

The preceding summary reflects the information provided to us by the people we interviewed. The views expressed in the summary, as in the cases which make up

the balance of this report, are their views of how well they did, and what might have been improved. During the course of this work, however, we were able to formulate some of our own impressions of the deployment procedures used. We have used this final section of the introduction to discuss some of those impressions.

A major problem we encountered in analysing the results was that we were dealing with a population of successes. We were not able to find a company with a 'failed' deployment willing to talk to us. Yet within this population of success, there were degrees of achievement. An exercise we undertook was to set up our own criteria for success — meeting budget, meeting deadlines, achieving cost savings and so on — and give our own subjective ranking of the companies. While all companies expressed contentment with the results of their deployments, we could see that there were parts of the process which could have been improved. Our conclusion was that without clearly set criteria for assessment, it was not possible for anyone to comment on the absolute success of the project.

What the exercise did do for us was highlight the aspects of the implementation which most often could have been improved upon. For example, there were a number of companies considered in this work which did not set clear objectives and targets for the implementation of information technology. Many companies had preconceived ideas about the information technology they wanted and spent little time or effort defining the problems to be solved. It is not clear whether the implementations would have been more successful had the firms better defined their problems, and thus had better specifications for their systems. The evidence may not surface for some years.

Although all the companies were able to achieve some sort of cost saving and improve the quality of their work, they frequently missed their deadlines for completion of the system, and consequently went substantially over budget. The costs of delays were not immediately apparent; indeed, the managers we interviewed tended to brush aside these costs as insignificant. They had not clearly quantified the cost to the firm of the additional hours put in by those involved in the

implementation. In some cases, the opportunity costs of this time were quite substantial.

The costs in some cases cannot have been minor. In three cases, the implementation was at least a year late in completion. There is no computation of the number of person-hours put in during that overtime period. This illustrates two weaknesses in the implementation process: **planning and management**. If the implementation process had been better planned, the initial budget might have reflected the additional time and costs incurred, allowing the managers to make decisions based on knowledge of the true cost of the deployment. If the project had been managed better, some problems might have been anticipated and either avoided or had their impact reduced.

To plan and manage deployments better, the managers must have considerable experience in this process, and detailed knowledge of the demands of the company's operation and the specifications of the technology. In most of these cases, the champions knew their companies well but had little experience with the technology. Yet few of these companies called on independent third parties for help in the process. The smaller companies in our sample (which also tended to be the ones with the least experience with technology) reacted against the suggestion that a consultant might be used. They felt that the expense would be excessive and that the value would be minimal. Some members of the expert panel felt that many consulting firms were not always 'independent third parties', but were sometimes "stalking horses for certain computer system vendors."

Many of the findings from this research have emphasized the gap between what is considered good practice and what actually happens. As one of our panel members commented, we are caught between an acknowledgement that the small firms in our sample use a non-bureaucratic style to remain efficient, and the belief that good deployment practice produces better results. The essential problem we had in analysing the experience of all these firms was the absence of objective criteria for evaluation; the lack of a definition of success allowed managers to be pleased with the results regardless of how much they might have been improved.

The population covered in this work was small- to medium-sized companies. One would expect this group, in contrast to large firms, to have a more hands-on approach to their operation, have fewer staff members, do less long-term planning or strategy, and avoid bureaucracy. These attributes are often inherent in the makeup of those who start small businesses and become part of the business culture. Some of these, however, make it difficult to embrace the collective wisdom of technology planning and investment.

In addition, these were mostly small projects within these small companies. In these instances, it may be considered more appropriate to use a less formal approach in deciding and planning for the deployment of a new system.

Good technology deployment practice suggests several rules for successful implementation:

- a champion is necessary to get the project going and keep it running smoothly;
- a cost-benefit analysis is necessary to define objectives and evaluate results;
- users should be consulted early on in the planning process to get their views on the system design and to promote 'ownership'; and
- a long-term technology plan should be developed to coordinate the various investments and ensure compatibility.

All of these are aspects of implementation planning which experience and common sense suggest should be present to ensure a successful deployment. What we have discovered, however, is a population of 15 generally successful instances where many of these rules were ignored. It is impossible to avoid asking why the companies ignored these commonly accepted practices and why they still managed to succeed.

The managers of many of these implementations, when questioned about their lack of planning, replied that the analysis was not necessary. They believed that they knew users' needs well enough, the benefits were immediately evident or there was no technology already in the company to plan for. It is hard to assess in retrospect, but the confidence of the champion that the decision already made about the system was indeed the correct one appears to have overpowered demands to attend to all steps in the planning process.

There appear to be three reasons for this. First, for five companies, the deployments described here were among their first experiences with information technology. As a result, they might not be expected to know about 'commonly accepted practice.' Second, the champions simply did what seemed sensible to them, without worrying about what others had done in similar situations. Third, the smaller companies in this sample tended to be guided by very tight time and financial constraints (perhaps a function of insufficient planning) and spent less time planning the purchase and implementation as a result. These three factors — lack of experience, lack of precedents and constraints on time — account for a large proportion of the cases where significant items in the planning process were left out.

The smaller companies were run by hands-on managers who knew their companies intimately. These champions went ahead and did what they thought was necessary, without spending time consulting and discussing the issues. The implementations in these cases were sufficiently small that this approach could work. This approach, characteristic of many business undertakings in smaller firms, may be unsuccessful as often as it is successful; because of the self-selecting nature of our sample, we have only seen successes. Furthermore, the success of such an approach would probably decrease as the firm grew and the size of deployment increased.

It has been suggested that the single most important factor for IT success is the company's attitude towards change. If the culture will allow change to take place easily, then the mechanics of that change will need less attention. This presupposes a security or stability within the company that allows change to happen without workers feeling threatened. It also involves being comfortable with the idea of

technology, assuming that the management and staff affected by the deployment do not feel threatened by technology. The lack of this positive attitude may be a significant impediment to deployment, as it would be with any other kind of change. Uncomfortableness with technology may be primarily a feature of little knowledge, in that one fears most that which is unknown. It may be appropriate to educate people in companies to promote the positive attitude by combatting any fear of technology.

Some of the installations described in this report were undertaken because the price of the technology had fallen sufficiently that the company could consider the purchase as a minor investment. Two of the cases involved the purchase of a first micro-computer system. Because the price was less of an issue than it had been in previous years, the management felt it was able to buy without embarking on a complicated procedure. In yet another case, the selection decision was made largely because the price was sufficiently low to allow investment without making it a decision to be made at a more senior level.

As a member of the Delphi panel observed, "It is often almost as if firms new to information technology, recognizing the real possibility of failure, have a firm limit in mind of how much they are prepared to risk. That leads to decisions not to hire consultants, or to skimp on user training which, if not the way more experienced users would act, may still lead to success as defined by these companies."

From the experience of other companies, one might expect that most small organizations purchased information technology systems for **cost avoidance**, either by cutting existing costs or by growing without increasing future costs. While most of our companies stated that this was an objective, it was surprising to discover so many organizations for whom this was not the primary motivation. The objectives which were identified concerned improved quality, faster delivery or greater efficiency. Each of these may result in reduced costs, but the managers saw the objective more in terms of the qualitative benefits, than as a cost-cutting exercise. This perception is part of the broader concept of cost-benefit analysis and the setting of quantifiable objectives.

Cost avoidance is the most readily apparent reason for justifying an investment and the most easily quantified. Many of our cases did mention cost avoidance as an objective — it is difficult to argue with it — but few placed it as more important than the qualitative benefits they were seeking.

Those companies which did set out to control costs had little or no idea of what the savings were after the implementation was complete. All were convinced that savings had been achieved, but, with one exception, **audits** had not been undertaken, and they had no practical scale for measuring any benefits that had accrued. For many managers, the concept of an audit suggested complex and time-consuming work. With the absence of clear criteria for success, it would indeed be very difficult to identify the benefits for the company.

Many suggested that there was no way to place a value on the benefits to the company, because benefits were 'soft', such as better quality of output, improved working conditions, faster processing or better information. It is not entirely clear from our discussions whether managers felt that it was impossible to measure these benefits, or whether they thought it was just too difficult to warrant the effort to devise a way to measure them. It is certain that they had no clear methodology to allow this analysis. In any event, few managers did any analysis of benefits after the implementation, yet all are pleased with the systems that they installed.

In the case of a modest deployment, it may well be that the gaining of experience in itself is a valid objective. The need to establish what they considered to be an extensive auditing system takes a backseat to the immediate desire of implementing a small system to gain some confidence for more substantial future deployments.

One might infer from the difficulty so many managers had with the formal measurement of the system that there may be a substantial population of other managers in Canadian industry who find this inability to evaluate a system sufficient deterrent to prevent them from buying any system. This may be a major impediment to deployment in this country. Marc Gerstein, in his book *The Technology Connection*, says that an insistence on hard-nosed criteria to evaluate IT

proposals is one of the nine "rules for failure" in IT deployment. If so, there is an apparent need to develop a methodology which would allow these managers to undertake such an evaluation more simply.

One of our Delphi panel suggested that an inability to quantify the needs and results associated with technological deployment provides "a sad commentary on our industry. How can we ever compete on world markets? Maybe this typifies why Canada is a non-entity in the industrial world." In this sense, what the case studies reveal as success (to date) may in the long-term turn out to be less successful deployments, lacking in cost-benefit and auditing details. Without clear objectives, the assessment of success will always be problematic.

From our experience, we know that the making of a technology plan, in conjunction with the corporate strategic plan, is beneficial. It is generally used, however, in companies which have some experience with technology. There are two general characteristics associated with companies with technology plans. First, the company has some form of technology around which a plan is developed to expand or extend the system. Second, the management must have sufficient experience with technology to appreciate the issues and constraints which guide the formation of a technology plan. The cases which did have such plans had the most straightforward implementations, because everyone was clear what was being done and had known about it well in advance.

The firms that did have technology plans were more ambitious in their deployments. It may be that if it were possible to stimulate the development of such plans in Canadian business, then companies would in turn undertake more substantial deployments. This presupposes that the need is indeed there, and all that is required is the experience and awareness to undertake the installation of large or elaborate systems. With that assumption, it might be useful to educate managers in the approaches to the development of a technology plan. What seems most likely is that as firms increase in size, technology plans (and other types of strategic plans) become more formalized and entrenched in the firms' culture.

Almost all the cases we studied relied heavily on the champion, to get the system selected and implemented. The two cases that did not use a champion had MIS departments and very clear planning and control mechanisms to evaluate the purchase decision and guide the implementation. It appears that, in spite of the need for a champion, companies with experience can embark on new deployments without a person in that role, if the infrastructure is there to support the process. This evolution from champion to institutionalization is similar to the evolution of companies from entrepreneurs to large organizations, setting up systems to handle the procedures that were initially handled by the entrepreneur. In the cases discussed here, in smaller organizations, the champion is most necessary where such an infrastructure is not in place, to give strength for the 'leap of faith'. It appears logical to conclude that the company must have either a champion or an established infrastructure to have a successful implementation.

It has been suggested that the champion has the unusual ability to see through the mystery of IT and perceive a computer system as a common 'artifact', in much the same way that managers of the 1920s considered typewriters. With this clarity of perception, the champion is able to reduce the importance of the purchase decision and thus bypass the need for elaborate cost justification.

It is not clear where champions come from, or what can be done to stimulate their growth. These people tend to be entrepreneurial — many were founders of the small firms we saw — and there appear to be similarities between the characteristics the entrepreneurial manager and the role of champion in a deployment. Many of these are the characteristics of a good leader in any situation. It is not part of our role to act as psychologist, but if it were possible to encourage the development of these champions, then the rate of IT deployment in Canada might be increased.

It is also suggested that champions possess a global view of the company's progress, with a broader awareness of the external forces that may come to bear upon the firm. Firms managed by individuals who lack this global awareness, who 'can't see the forest for the trees', tend to lack champions of technological innovation. Certain Delphi panel members expressed the opinion that champions in

many organizations tend to be relatively new in their position. The fact that individuals are not yet 'dug in, channelled or into a rut' suggests that they are less defensive, somewhat more invigorated and perhaps more willing to implement technological change and see the implementation through to conclusion.

The general level of knowledge of different technologies among the champions we met, with a few exceptions, was not high. They rely on, and have confidence in, individuals within their companies who are on top of the technological scene. One would expect that a lack of awareness of technological solutions would be a barrier to deployment in those instances where neither champion nor assistant are technologically competent.

In our cases, only three of the companies stated that competitiveness was a factor in the purchase decision. These companies felt that there was a competitive edge to be gained by being seen as leaders in technology for the industry. In fact, a much larger proportion had implicit concerns about competitiveness and addressed these by trying to get costs down, improve quality or speed up delivery. All of these benefits would be passed on to their customers in some way, thus improving the companies' competitive positions.

One of our Delphi panel commented that a growing trend in information technology deployment is the integration of suppliers' systems with those of their major customers. This integration happened in only one of our cases. It is perhaps most prevalent to date among auto-part manufacturers and will become increasingly common in industries where just-in-time production systems exist. In this sense, competitiveness and external influence will provide important stimuli to the deployment of information technology.

The effect that the technologies have had on the operation of the companies in these cases has varied considerably, from several installations that had little effect to the few that appear to have transformed the organization. It is interesting that within our small sample, the degree of 'transformation' has a direct correlation with the formality of the evaluation process: those companies (the 'Greenfield' site is the

most extreme example) that installed systems that had the most effect on the company as a whole also did the most rigorous analysis of the costs and benefits before proceeding. It is not entirely clear where the causality lies; major transformations may require rigorous cost-benefit analysis, but such analyses may not always lead to such a transformation.

An additional factor that was raised by one of the panel members was the role **expectations** (as distinct from objectives) play in the deployment process. The expectations that were encountered in these cases were of two kinds: those that related to the outcomes and benefits (such as improved work environment, more efficient production, easier access to information) and those that related to the implementation process. To the extent that the first kind were held at all, the result from our sample is that these expectations were met. The expectations for the process, however, were unrealistic in many of the cases — the implementation period for some was 100 percent longer than planned.

The identification of these expectations, and their management, are important parts of any deployment plan. We have seen how most of these firms did not set clear objectives; yet the expected benefits in the minds of most people involved in or affected by the deployment were indeed met. Some of this may be post-rationalization, but the individuals did indeed express satisfaction. The less successful part was the management of the expectations of the process, yet the companies which took longer to implement the systems than planned still felt that the deployment was a success. Clearly, they feel that if the benefits are achieved at the end, the delay is not important.

In summary, it appears that the single most important factor in new technology deployment in the small companies included in our sample was the presence of a champion to initiate the process and guide it through to completion. All other conventional wisdom about the process gives insight into those features that assist in successful implementation but does not describe essential elements in that process.

We have examples of successful implementation where the champion simply made up his own mind, did a little shopping and had a system installed.

The companies in our sample have managed to get systems up and running. They express satisfaction at the result and consider the deployment a success. It is not possible to evaluate their success without clearly set objectives; it may be that some of these cases would not be considered successes if such criteria were available. Much of the satisfaction the managers feel about their deployments comes from the increased knowledge they have gained from the experience. They are all in better positions to embark on new deployments, and be more ambitious, than they were when they set out on their projects.

The encouraging thing is that, even without a complex business-school approach, great support and lots of experience, companies are succeeding in getting new technologies installed and working. It is not possible to endorse the lack of such planning as good business strategy — indeed, many of the approaches we encountered might not have succeeded on larger deployments — but it is clear that managers should not be intimidated by complex formal methods when simple assessments may be sufficient.

Case Studies

Case:	Company A
Industry:	Wholesaler
Size:	Revenues more than $100 million; 1500 customers
Location:	Ontario
System:	Order entry system for customers

The Company

This company is a wholesaler of products to a large number of consumer product retailers across Canada. The company supplies a number of franchised outlets, as well as independent retailers and a few buying groups.

Company A has been in operation for more than 80 years and is based in southern Ontario. About 20 years ago, the company started offering a franchise to retailers, providing steady supply and branding for products. The number of outlets this company serves are listed below:

Type of Customer	Numbers of Customers
Franchised Dealers	300
Independent Dealers	350
Five Buying Groups	700

The 300 franchised dealers, combined with the five buying groups, account for 90 percent of the company's sales. The company has revenues of more than $100 million and a return on net worth exceeding 10 percent. The 1981 recession hit the industry severely, and a number of retailers went out of business. Competition between the wholesalers in this industry is very strong, and margins have been kept low to remain competitive.

Company A considers itself to be a leader in the use of information technology, having been the first to apply several technologies in the 1970s and 1980s. For some years, the company has been spending about 1 to 1.5 percent of sales on its information technology systems. In the current year, the company plans to reduce this to 0.8% of sales, in an effort to improve profitability. These figures have gathered the strength of tradition. There is no objective reason for 1 to 1.5 percent of sales to be a cutoff point; the company has been operating at that level for long enough to consider relative change as the important measure, rather than absolute value. Company A has been running a mainframe for many years and has recently purchased a second computer to be twinned with the first to provide more capacity, and some backup.

The company has been running general management information and accounting systems on computers for at least 20 years. It has also been operating a substantial inventory control system for many years. The systems purchased during the 1980s, including the one discussed in this case study, were considered enhancements to the existing operations rather than stand-alone systems.

The System

The company has installed 425 communications terminals in their customers' offices (primarily retail outlets), connected via i-Net to the wholesaler's computer. The innovative aspect of this system was that it allowed for two-way communications: the system allows retail managers to place orders directly with the wholesaler and to get quick confirmation of the order and any items that were not available. The terminal connects through i-Net to the wholesaler's Series/1 computer, which in turn is linked through a telecommunications controller to the company mainframe. The wholesaler had an existing inventory control system, and some dealers were already using hand-held terminals to place their orders electronically.

The system was designed to facilitate communications between the wholesaler and the dealers. The 60 sales staff also use the system to communicate both with the

head office and with their dealers through an electronic messaging facility. The distribution department also uses the system to receive orders for processing.

The Purchase Decision

The decision to purchase a new system was made by the vice-president in charge of accounting and finance, who was also the person who decided what was needed, selected the system, planned the implementation and took ultimate responsibility for the success of the project. The vice-president is one of five senior managers, each of whom reports directly to the president. An expenditure of this kind requires board approval and the support of the entire executive group prior to proceeding. The initial idea came to the vice-president at a trade show where the technology was on display.

The technology was not designed for this application, so it was some time before the vendor reconfigured the system to the needs of this company. Indeed, the purchase decision was contingent on the technology being able to perform as required. Once the vice-president had convinced the supplier that the system could in fact work, the supplier then made a decision to develop this application (somewhat influenced by the fact that the official application of this system was not selling as well as expected). This initial rapport with the supplier was an important factor in the selection of the system.

The vice-president has no formal technological training, but keeps up-to-date with computer technology by visiting trade shows and reading trade press. He takes DP responsibilities seriously, and takes pride in the success which they have brought the company. He is very enthusiastic about the benefits of technology and works to convince other senior managers of the company and the dealers to take better advantage of the systems they have.

The project was conceived as part of the continual process of trying to improve the speed and efficiency of communication between dealers and the wholesaler. Many

dealers were already using hand-held terminals in the stores to record orders to be placed. These dealers were able to transmit these orders electronically to the wholesaler. They were not, however, able to get confirmation of their order until the shipment arrived in their store, when they would discover whether they got what they ordered or not. If part of the order was not able to be filled, they would then have to place another order and wait for it to be fulfilled. If an item were crucial, the dealer could telephone in the order, but the line was frequently busy, requiring several calls and a lot of wasted time.

The pressure to improve this communication and delivery system was competitive. It is crucially important to be able to fill the retailers' orders quickly, and to fill as many of the items ordered as possible. If retailers get slow service, or find a large proportion of their orders unfilled, they will lose customers and consider changing to another wholesaler. Company A tries to anticipate the needs of the retailers, realizing that the more business the dealer does, the better the business for the wholesaler. The company would also like to ensure wherever possible that the dealer always places orders with Company A and not other wholesalers; any mechanism that ties the dealer to the supplier would be considered advantageous.

There were internal pressures on performance that also influenced the decision. The company wished to improve its profitability, through better cost control, so any investment would need to be seen to save money.

The company has an annual technology plan, which is prepared in conjunction with the company's strategic plan. From a large 'wish list', the company prepares a plan of systems and upgrades to be implemented during the year. In general, there is a ceiling level for investment, set at between 1 percent and 1.5 percent of projected sales. The vice-president and the Manager of Information Systems prioritize their 'wish list' in cooperation with the CEO and vice-presidents and plan to implement as much as they can within that budget.

The benefits of the system of communications terminals were initially identified as follows:

- save two salaried positions (employees who answered telephone enquiries);
- improve communications with dealers;
- fulfil orders more efficiently; and
- allow dealers to select substitute products for out-of-stock items.

The first of these was the only benefit to be quantified; as a result, the 'cost-benefit analysis' was not a formal exercise. A back-of-the-envelope calculation suggested that the savings of two salaries would cover the direct cost of the system to the wholesaler, and that the rental cost and the on-line costs would be borne by the dealers. This gave sufficient return to decide the investment was worthwhile. Although no detailed analysis has been carried out, the managers are convinced that this has been confirmed in hindsight.

The vice-president and the director of systems felt they had a clear idea of the needs of the dealers after discussion with the dealer advisory groups. A pilot program was planned for the implementation, during which any unforeseen needs of dealers would be considered. Once the idea for this system was conceived, there was a delay to find out whether the technology could do what was being demanded of it. The DP department and the supplier worked together to develop the system: the purchase decision was made once the system was performing as required. It was clear, however, that the initial investment was not large and that future costs would be borne by the dealers as they were incurred.

There was some concern about resistance among dealers to this new system. The resistance was expected from those who were not comfortable with technology and from those who were not able to understand how they were to operate the technology. Considerable effort was made to ensure that the 'front end' of the system was clearly labeled and easy to use.

The aim was to get as many dealers as possible to use the system. The sales staff was directed to encourage the use of the system on every visit to their dealers. An unexpected impediment appeared when it became clear that not all of the sales staff were interested in the technology. Company staff discovered that some of the

salespeople were actively discouraging the dealers from using the new system, so they would not have to cope with the system themselves. More care was subsequently taken to give the sales staff more training and to overcome any inhibitions they had about using the system.

This implementation is considered to be a success. There have been 400 (425) terminals installed, and the company has reduced its staff as planned. There are still dealers who do not use the system, and some sales staff who "will probably never use it." These are in the minority, however, and the company expects most of their business to be transacted on this system in the future.

In selecting this system, the vice-president saw the installation as a state-of-the-art system. He was not aware of any other technology that existed which could do the same job. He believed that it would remain at the forefront of technology for some time to come. There was no feeling for the length of time this system would remain current. Nor was there a vision of the lifecycle of the technology or the next generation of systems which would replace this one. The vice-president was confident that the system would meet their needs for the foreseeable future.

The Selection Process

The purchase decision was not made until the system was selected, and there was some assurance that the system could do what was being required of it. The vice-president was aware of other technologies that might have been used, but no formal analysis was made. The vendor offered considerable support to develop the new system, and this was the deciding factor in the purchase.

The two criteria that were considered most important were cost and user friendliness, in that order. The company believed that the users would not agree to try the system if the cost were too high; since the dealers were required to pay a monthly rental for the terminal, the immediate returns for using the system would have to be high enough to justify this outlay. The second impediment to implementation was

the ease of use; the company was concerned that the dealers might be put off by a system that was difficult to understand or operate. It was seen to be vital to the success of the project that a high level of use be attained.

The functional aspects of the implementation required consideration. Since the application was one which had not been tested before, there were many discussions between the DP department and the supplier about the work required to install the system. The supplier was very cooperative, although it had some initial doubts that the system, designed to operate in a different way, would be able to fulfil the needs of Company A. Once it was clear that this system would work, the implementation proceeded.

Implementation

The people responsible for the implementation were the same ones who selected the system. Because this was a new system, a testing period was used to make sure that the system would work and that the dealers were able to use it. This was the first opportunity that users had to get involved in this process. Fifteen dealers were selected for a trial period of six months. They were gathered together for a one-day training session given by the supplier.

During the trial, several technical hitches were encountered which required attention from the supplier. The machines were very slow, requiring many keystrokes and several minutes simply to sign on. In addition, the Datapac network was being used as the communications link between the dealers and the company. Some dealers were having to incur long distance charges to connect to the network. This additional cost had not been factored into the project costings, on the assurance from Bell Canada that Datapac would have sufficient centres across the country that long distance charges would not be necessary. Datapac was slow in establishing these centres, and some dealers had to pay more during the interim, until Bell established a toll free number to allow access to the network.

After the six-month pilot period, Company A evaluated the experience of the 15 dealers and decided to proceed with the full installation. All dealers were approached to try the system at no charge for an initial period, to encourage them to install the system. The company explained that the charge for using the system, after the free trial period, would be only $50 per month, but that the returns from only a small increase in sales by improved ordering would more than cover this cost. The sales staff were given instructions to present each of the dealers in their region with information on the system and encourage them to use the system.

Users

There are three user groups involved in this system: the dealers who installed the system to place orders, the sales staff who use the system to communicate with both the head office and their dealers, and the staff in the distribution department who take information from the system to process the orders. Most of the planning for the system concerned the dealers. Company A admits now that more time should have been spent with the sales force, training them on the system and showing them how to sell the system to the dealers. The sales force was very important in getting the system installed. The distribution department has been computerized for some years, and the change for the department was simply to streamline its operation and to eliminate the need for some customer service staff to answer telephone enquiries. The comments in the rest of this section concern the dealers.

The user groups were not involved in the decision-making process or system selection. Once the system was running, the focus of the DP department was to involve the users as much as possible. A large proportion of the dealers were already using hand-held terminals to prepare their orders. These terminals were designed to allow direct communication with the host computer; what they lacked was the ability to confirm an order. The new system was an extension of the existing system, requiring a change in the input procedure to allow two-way communication.

The dealers were sold the system on the understanding that it would increase their sales. The company reports that some dealers are not using the system as much as they should to get full benefit from it. For these dealers, the investment is clearly not worth it. Other dealers feel that their sales have increased and that the system provides good value. In addition to the increase in sales, dealers consider the service they offer their customers to be faster and more efficient as a result of using these terminals.

The use of the system has created the need for the company to operate a 'reserve stock' process to serve the dealers better. This change was unforeseen but has resulted in a more efficient stock control system. This was an additional cost the company had to bear, but was not factored into the costing of this system because it was implemented later. The company believes it to be a benefit to the operation of the company in its own right.

The system clearly belongs to Company A, with the dealers being allowed access to it. There are a number of other operations that the system can support, including electronic messaging. The company has found it difficult to get these other functions used; users perceive little advantage in using these features, preferring tried and true methods such as the telephone.

Conclusions

The success that Company A has had with this application is primarily attributable to the planning which went into the installation. The planning included the information technology portion of the corporate strategic plan, the selection of this system, the configuring of this system to the needs of the company and the development of the 'user-friendly' front end. The company was also careful to minimize the risk of this installation by keeping the cost down and by providing a cost-benefit analysis for the dealers. Both the planning and the minimization of risk reflect the experience that the company has gained from previous work with information technology.

Much of the success of this installation is the result of the strong relationship between the company and the supplier of the system. Wthout this support, the implementation would not have been attempted. However, the single most important force behind this successful implementation was the influence of the 'champion'. The vice-president was involved at every step of this implementation and guided the project over the important hurdles. This leadership was instrumental in the smooth implementation of this system.

The company is proud of this deployment and believes that it has been a success. There were no parts which the company would have wished to have done differently. The lack of detailed evaluation of the system either before selection or after implementation might be considered a crucial omission, yet the company seems to have produced a successful system regardless. It would appear that the presence of a capable champion and a cooperative supplier were more important than these evaluations.

The company believes it has increased its competitive advantage in the marketplace, by tying many of its customers (the dealers) to its supply, thereby lessening the likelihood of the dealers' using other suppliers. The company's sales have increased, but the managers do not attribute this solely to the installation of this system. They consider that they are in a stronger position to attract new customers and can provide a more efficient service to all customers (and hence make more sales) as a result of this deployment.

In summary, the lessons learned from this case include:

- the presence of a senior manager to 'champion' the project has ensured that it was treated with importance in the company;

- it is important to include all user groups in the process as early as possible, to avoid having blockers for the project and to give users a chance to buy into the system; and

- the lack of explicit evaluation of the anticipated or actual benefits does not appear to have been an impediment to success in a company small enough for senior management to be immediately aware of changes in performance.

Case:	Company B
Industry:	Forest products
Size:	400 employees at mill site; approximately $150 million in annual production
Location:	Western Canada
System:	A series of program logic controllers for process control

The Company

When established in the 1950s, the company was one of the largest pulp mills in the country, supplying pulp to various paper producers in Canada and the United States. Currently the company employs 400 at its mill site and an additional 400 in its stud mill and woodlands.

The company's primary wood in the mill process consists of spruce and pine trees with minor amounts of balsam fir. Annual pulp production at the mill totals approximately $150 million. Its two largest customers are paper mills in the northeastern United States. The company is part of a multi-billion dollar U.S. chain of pulp, paper and newsprint companies.

As one of the older pulp mills in Canada, the equipment and process used by Company B is relatively antiquated. The company faces diminishing parts availability and outdated technology which, in recent years, has led to increasingly frequent downtime. The time involved in diagnosing and repairing problems was the major motivating factor for the installation described in this case study. The company has made attempts over the past five years to modernize certain aspects of the mill, including the cleaning, knotting, demineralization and baling phases. This case documents various aspects of these improvements.

The System

During the past five years, Company B has installed a series of program logic controllers (PLCs) to improve efficiency and decrease costs. Connected to the input side of a PLC are such things as limit switches, pressure switches, level switches and other signals. Devices that conduct work, such as solenoids, motor starter coils, lights and alarms, are connected to the output side.

The technology replaces the extensive series of relays, vacuum tubes, other mechanical parts and wires that formerly channelled the logic and decision making. Prior to the implementation of the system, all input and output activities of this kind had to be hard wired with the resulting difficulty in diagnosing breakdowns and repairing problem areas. The company has implemented PLCs in six areas of the mill, including the cleaner system area, the knotter system area and the baleline/packaging area. Aside from the PLCs, the company has no other systems-related installations in the mill.

The PLCs operate from three sets of software: one programs the system's logic, one programs the system's documentation and one allows a compatible personal computer to communicate with the PLC.

The Purchase Decision

The system documented in this case is not particularly sophisticated. At the time of implementation, there were many other industrial users who had either made similar improvements of a piecemeal nature or who had installed programmable logic controllers as part of a new construction. Company B's managers, particularly in the maintenance and engineering areas, had been aware of the potential value of the PLCs for many years prior to the first implementation. These individuals' responsibilities increasingly included those areas most directly affected by age-related failures within the mill. For approximately three years, the maintenance and electrical divisions had been dealing with increasing numbers of worn out relays,

dirty contacts and wiring problems. The nature of the old system, with massive panels of wires and relays, made it very difficult to diagnose problems and to repair these problems once diagnosed. Clearly, a system that could reduce problems and downtime and facilitate quick diagnosis of problems upon occurrence would be a positive addition to the mill.

Although not easily quantified, maintenance and repair costs would be reduced through the implementation of such a system. In addition, replacement parts were becoming more difficult to obtain and PLC implementation was viewed as a way to make processes more efficient without simply replacing and rewiring the same parts as usual.

The operations of the pulp mill, like most manufacturing processes, involve distinct phases and processes. Company B's first PLC implementation was in the water demineralization system. While improved control of this aspect would clearly lead to better water and in turn to a better-quality final pulp product, it is quite difficult to draw a quantifiable connection between the two. The basis for the decision to implement such a system, as described in the following section, would then be more intuitive than numerical.

The maintenance, electrical and engineering officials of Company B made three proposals to the executive of the firm before agreement was reached to implement the first PLC system. It is the opinion of certain maintenance and engineering personnel that their role as 'providers of service' limited their impact upon decision making. Short-term financial and operational matters tended to dominate the decision-making process.

The cost of the first system, approximately $6000, was within the approval jurisdiction of local management. Three proposals outlined in a general manner the savings that would be recognized through reduced trouble-shooting, downtime, repair costs, wiring and material costs. The third proposal eventually led management to concur that such improvements were inevitable and that the mill "would have to get its feet wet sometime." Furthermore, the scope (and projected cost) of the approved

project was proposed in such a manner as to be easily managed and therefore acceptable to senior management. In making such a proposal, certain maintenance personnel, including the 'champion' of the project, had discussed prices and characteristics with a potential vendor on a couple of occasions and had reflected these estimates into the proposal. This vendor, referred to as AB, was considered to be one of the leaders in the field, with successful implementations in many other pulp and industrial facilities.

Given that three proposals were required, it appears that the resident manager of the firm was somewhat reluctant to invest in this technology. However, it was estimated that downtime cost the company annual production of dry pulp worth some half-million dollars. Any reduction in this would have some tangible value to the company.

Company B's most recent implementation allowed the pressing, wrapping, baling and stacking stages to be PLC controlled. This system was purchased and implemented in two stages to reduce the annual budgeting requirements and to ease the actual physical handling of the implementation. Company B does not have a separate 'technology or systems' budget; rather, such expenditures are part of the general budget.

In each of Company B's implementations to date, the cost has been within the approval mandate of the local resident manager, or distributed in such a way that each phase is within this mandate.

The involvement of a foreign parent company and the requirement for outside approval should the capital investment exceed a certain level have served to limit the scope of the improvements. The improvements have, as a result, been of a patchwork nature wherein successive implementations were in large part dependent on the success of the previous implementation. Furthermore, each system is currently of a 'stand-alone' nature — there is no integration between them.

The small scale of the implementations created instances where old equipment was forced to marry new controls. For example, the baling-line installation required that hydraulic-fluid flow rates be reduced to mesh with the logic speed of the PLC. In this and other instances, the engineering and maintenance personnel would have preferred to increase the scope of the installation rather than cutting corners by forcing new technology on old equipment. Managerial insensitivity toward technical matters may have led to 'nickel and diming' in certain installations and subsequently to added 'fire-fighting' during the implementation period. Certainly this was the opinion expressed to us by some of Company B's engineers.

The engineering and maintenance groups which pushed for PLC implementation are 'service' departments with no decision-making authority. The organizational structure is such that these groups provide a service to the other groups — they have no authority to impose new technologies or systems, nor do they have any form of 'long-term planning' mandate. Such an organizational structure "risks minimizing the input of these groups at the expense of the long-term efficiency of the firm as a whole." It may also make certain managers reluctant to communicate at the risk of displaying technical ignorance. Certainly, there appears to be no requirement on the part of these managers to discuss matters with the engineering and maintenance groups. Rather the latter are brought in whenever a 'fire-fighting' situation arises.

The Selection Process

An initial contact by AB was made in 1982. Company B was impressed by AB at this initial meeting. A few subsequent meetings with the vendor's sales force increased Company B's confidence in AB's equipment and implementation plan. During the selection process, the company spoke with other pulp mills and businesses who had installed AB's equipment; the general impression was very positive. Three other vendors also made calls to B during the selection and implementation phases of its various piecemeal improvements. This system was felt by Company B to be the most appropriate at the time of the first implementation.

Subsequent purchases, such as the recent baling-line PLC, went to the same supplier because of user familiarity and parts and service availability.

The superintendent of the mill has traditionally attended an annual convention with 10 to 15 other mill superintendents, who meet to discuss problems, technologies, equipment, training and other matters of mutual interest. These meetings were relatively informal and presented the opportunity to renew acquaintances and to discuss common issues and interests. Such meetings were also instrumental in increasing B's familiarity with PLCs, particularly with regard to the associated uses, problems, benefits and suppliers. The fact that many friends had implemented similar systems reinforced the superintendent's conviction toward installing them in several areas of the mill. Technical and implementation advice was also commonly exchanged during these meetings.

The policy for selecting the first system reflected a 'functional yet affordable' attitude, in the belief that successful and cost-effective deployment of the initial system would lead to subsequent deployments in other areas of the firm's production process. This has proven to be the case; five PLC implementations have subsequently taken place.

During the selection process, certain key individuals within the maintenance group met informally with the heads of the user departments (pulping, digester, steam-power, machine room, lime kelm) who would be affected by any eventual implementation. Discussed would be such matters as the potential advantages of the PLCs and the progress made through PLCs in other areas of the mill.

The department heads were initially reluctant to change from the hard-wiring method with which they were familiar and comfortable. They eventually became more supportive once PLCs were gradually introduced in other areas of the mill. For example, the head of the steam-power department was quite difficult to sell on the merits of a PLC for the demineralization system. It was the nature of this individual to remain skeptical, though when convinced of the merits of a PLC for reducing downtime, the manager became a strong supporter of the project during subsequent

meetings with the company's resident manager. As mentioned, once the initial system was implemented, the smoothness and perceived benefits of the implementation made similar systems easier to sell in other problem areas of the firm.

From the perspective of the resident manager, the cost and availability of local support were the main decision factors. The supplier's parts and service capability in the province was a key element of the decision. Over the years, AB had built up a strong presence in many industries in B's region, in part the result of its strong support network.

Implementation

The implementation of the various PLC systems has been relatively smooth and trouble-free. The systems were installed by the electrical and engineering personnel, with the assistance of the vendor where necessary. Installation primarily involved the plugging in of hardware, the correct setting of switches and the use of vendor manuals to program the desired programs and 'contacts'. The three to four hours required to initially program the system represented "a fraction of the time formerly required to hard wire a similar system." Furthermore, once programmed, subsequent changes to the program could be made in a matter of minutes, or even seconds.

The training provided by the software supplier, another local firm, was minimal. The training consisted mainly of a one-afternoon session wherein "he covered so much, I forgot everything he said." The software decisions were made after the PLC purchase, and they were motivated by the fact that the PLC system had no back-up or documentation capability included as part of the purchase. The software system combined with a personal computer, then, allowed both the documentation of PLC programs and, if desired, the off-site programming of the PLC.

During the two years following the initial PLC implementation, Company B sent its engineers, electricians, maintenance staff and others to week-long AB training

courses in Edmonton. While the requirement for training is actually limited to a handful of employees, the company felt that such a course would be useful to increase the employee's level of comfort with the system, their understanding of the programs and their ability to quickly diagnose problems. The vendor also provided a couple of one-day seminars on the basic programming and setting up of the system.

Certain individuals within the engineering department were quite computer literate. One in particular became prominent during the implementation for his software development and informal training skills. He was instrumental in increasing the computer literacy level of the company so that several employees could diagnose and subsequently repair problems. The firm actively supported this and other forms of training both on- and off-site, to achieve a level where users could "use and live with the system without necessarily mastering it."

From the operational perspective, ease and reliability of use were among the main selection criteria and both of these were improved with the different PLC installations. There was a learning period on the baling-line implementation, for instance, of about 10 days, during which informal training was directed toward problem recognition and maintenance tuning. In retrospect, individuals on the operational side feel that B should have contracted 'a bit more' support from AB during this period — that having a trouble-shooter and system expert available at all times may have cleared up certain problems more quickly.

The receptiveness toward training was felt to be influenced most by the background and attitude of company personnel. Age was not felt to be a factor in receptiveness.

Because pulp mills traditionally run 24 hours per day with periodic week-long maintenance shutdowns, the implementation was easily accommodated during the shutdown periods. The electrical crew of 15 hourly and 3 supervisory personnel worked overtime during these shutdowns to complete normal maintenance as well as the installation of the PLCs.

Users

The ultimate users of the system — that is, the employees who push the control buttons — remained virtually unaffected by the system. They continued to push the same buttons, largely impervious to the fact that the control, alarms, reliability and repairability of the system had been greatly improved. There was no change in employment resulting from the implementation.

The opinion of certain individuals was that the company had been too generous in its training, that everyone was willing to go on the training course because "everyone enjoys a week-long course out of town." The implication is that most of the individuals sent on the course did not display further interest in learning the details of the system. For example, it is estimated that of the 12 maintenance personnel who have had training in the area, only two are comfortable enough with the system to be "called in at 2 a.m. to fix a break-down or diagnose a problem." In this respect, it was recommended that pay or hiring policies be re-structured to reflect the degree to which the required individuals have "bought into the system."

The engineers whose work was indeed changed by these implementations were part of the selection and implementation planning process and were responsible for getting the system to do what they wanted it to do.

Conclusions

The initial motivation for the implementation in this company was largely reactive and "by default." The costs of downtime, trouble-shooting, repairs and parts had reached a level which surpassed that of implementing new systems. Management from the maintenance and engineering branches of the firm were the initial promoters of a new system simply because they were the branches most directly affected on a daily basis.

As one of the older mills of its type in the country, the decision facing management regarding PLC implementation was complicated. The resulting compromise basically introduced six PLCs over a span of five years, in an attempt to improve the efficiency of various individual processes. The approval mandate of the firm, as a foreign-owned subsidiary, was limited in scope, and this was a factor behind the limited nature of the implementations.

The champions of the implementations followed an informal strategy of installing one PLC at a time. If the initial installations 'proved itself', subsequent implementations would be easier to sell to the other managers. Those involved in the modernization of the mill concur that small PLC-related improvements of the mill represented the only viable option open to the firm.

Case:	Company C
Industry:	Food supplier and franchiser
Size:	Sales of approximately $200 million; 150 retail outlets
Location:	Quebec
System:	Telephone ordering system, sales information system at sites

The Company

The Company sells franchises for fast-food outlets and maintains supply and financial control over all outlets. At present, the company is responsible for approximately 150 outlets in eastern Canada.

The company has been in existence since 1952 and had sales of slightly below $200 million in 1987. The company's most important strategic initiative involves further expansion in Ontario and the western provinces.

In 1982, the company investigated the possibility of implementing automated systems to improve overall management efficiency. However, because of a reduction in sales in the recession of the early 1980s and the lack of a significant commitment to the project, no significant action was taken in 1982. At that time, the company's only technology was a management information and accounting system that had been in place since 1978 to compile information produced manually by outlets and transmit it to head office by telephone on a weekly basis.

In 1986 the current vice-president of finance joined the company. He came from a manufacturing environment where he had become familiar with the benefits of computerized information systems. Shortly after joining the company, he pursued the information system initiative which had begun in 1982. He expects to review and, if necessary, revise the information system every two years.

The System

The system has three components. The first component installed a centralized telephone ordering system. Originally, a manual process was used where telephone orders were taken by hand, then passed to one of six employees (part-time positions) who matched the order to the nearest outlet, dialed the outlet's number and transmitted the invoice information electronically. Under the new system, the orders are dispatched electronically by the person receiving the order to the outlet closest to the customer, thereby eliminating the dialing and re-entry of order data.

The second component of the system linked the company with all outlets to monitor and record sales. The information is transmitted daily and is used by head office to schedule supply shipments, record volume and sales, and produce management and financial reports.

The third component involved upgrading the existing internal administrative and accounting system.

It is important to note that the entire operation, including central ordering and the restaurants, was very systematized, but was paper-based. For example, restaurant management had to devote approximately 70 to 80 hours per week to complete management documentation. As a result, the objective of the new system was to automate the manual system and processes already in place.

The system operates on a new mini-computer; the configuration and all the software is custom designed for this company's application.

As of May 1988, the system is in place at only three pilot sites. As a result, a complete perspective from all users is not yet possible. The comments related to users reflect only those at the pilot sites.

The Purchase Decision

Upon his arrival, the vice-president of finance undertook a formal cost-benefit analysis to determine the financial viability of a new information system. His reason for pursuing the system initiative was based primarily on three factors. First, he recognized that their existing management information system was deficient in terms of accuracy and timeliness. Second, he believed that other food franchise outlets were more advanced than Company C's in terms of automation. As a result, there was a competitive pressure to automate. Third, he recognized that more management information was needed for a company of its size and reporting requirements. He indicated that this automation initiative was second only to expansion as the most important strategic issue explicitly identified by the company. The new system was seen as a way to better manage the restaurants.

A formal cost-benefit and technology plan was produced soon after the vice-president's arrival in 1986. The cost-benefit analysis was based on actual expected savings in time as a result of reduced workload compared with the forecast costs of the overall project. Also, a technology plan outlining the fundamental principles and components of the system was developed. Once these documents were completed, they were presented to the company's executive committee to obtain a 'go-ahead' on the project. The executive committee was very familiar with project evaluation proposals since they regularly reviewed applications for new franchises and other projects such as market studies.

Users were not consulted during the decision process since Company C was supplying the system, and it was assumed that restaurant managers would gratefully accept all automation initiatives. It is important to note that Company C already had direct experience in the centralized automation of restaurant operations, and they were very familiar with the necessary user components.

The overall project budget was approximately $2.5 million with $1.3 million designated for hardware, $1 million designated for system and software development and $250 000 for training. Their analysis estimated the project's internal rate of

return at 35 percent, providing a payback of approximately three years. The benefits involved almost exclusively savings attributed to reduced effort in administrative and managerial tasks. The project was approved without opposition.

The Selection Process

Once the project was approved, responsibility for the project was transferred to the director of computer services who reported to the vice-president of finance. Based on the contents of the technology plan, the computer services (CS) group contacted a number of hardware suppliers to identify the types of hardware available to meet the system needs. They also retained the services of a firm of management consultants to provide an outside perspective on the system and to confirm the direction and decisions taken by the CS group. The vice-president indicated that it was sometimes difficult to ensure the objectivity of the consultant since they were also system suppliers.

Four computer suppliers submitted proposals for hardware. A formal selection process was followed and lasted about two weeks. Six weighted factors were used in the selection: supplier capability, cost, hardware suitability, system suitability, availability of support and availability of training. As part of the selection process, the CS group contacted other users of the technologies. However, no restaurant applications existed. Because this represented a custom system, it was not possible to test the hardware.

The company selected the supplier which offered the highest score on these criteria, in spite of being a different supplier from the one the company had already been using (who offered the lowest cost). The consultant provided advice throughout this process. By the time the hardware was selected, the system's physical design was completed. Only the detailed components and software needed to be developed and implemented.

Once the hardware was selected, the CS group contacted several software companies to discuss and evaluate their capabilities. The group was already very familiar with the capabilities of accounting and management information systems and was therefore able to select the most capable and appropriate software contractor. The selection of software was a complex issue since the company's needs demanded a customized system that could accommodate three corporate divisions, two languages and a distributed franchise network. The software supplier was selected based on the CS group's research. Proposals were not requested.

Users were not consulted extensively during the selection phase. They were only questioned on their thoughts of what components of the existing paper-based system should be automated on the new system.

Implementation

The first step following selection involved training the company's CS group on the new hardware. This training was received enthusiastically as an opportunity to address new challenges. The suppliers provided only the hardware and technical advice. The actual implementation was done by company personnel.

A major initiative involved the development of a communications plan for all company employees and all franchise restaurant managers. The vice-president believes that this communications plan contributed significantly to the success of the system implementation (so far). He also indicated that, in hindsight, he would have devoted even more effort to this plan.

Another major initiative involved the development of training sessions for company staff and restaurant managers. Managers at all levels of the organization attended courses on organizational change. Also, with grant funds from federal-provincial programs, accounting and information technology training has been provided to head office staff, and plans are in place to train the 150 restaurant managers. This

training for restaurant managers was given in two sessions: the first in May and June, and the second in August and September 1988.

The vice-president attributes most of the credit for a successful development and implementation to the CS group. He believes that its persistence in pushing each activity to its logical conclusion resulted in a successful project. He also recognizes that his backing also provided the project with the necessary high profile with respect to corporate management.

The major difficulty in implementing the head office management accounting system involved time delays in installing individual modules. Because of these delays, there was insufficient time to test this system, and there was no parallel run. This timing problem pressured staff into accepting the system more quickly. The vice-president is confident there was no risk arising from the quick transfer to the new system. According to the vice-president, this rush might have been avoided with a more thorough communications plan or if more attention had been paid to office staff's needs. However, either of these would have taken additional time when the project timeframe was already very limited. To date, only benefits related to accuracy have been realized, since the company is only in the transition phase. Improved timeliness is expected to be achieved in the near future.

After the system implementation, the company reached an impasse with the software supplier on who would be the eventual owner of the software. The software company wanted to retain ownership for maintenance and further marketing purposes, whereas the company wanted to own the system to provide the right to add to the system as new franchises were opened. This impasse lasted three weeks during which time the system development work was stopped. This break in development also provided management with a three-week "breathing period" to "catch up" on all aspects of their work. Company C now owns the software, and the supplier only has a limited commitment to maintaining the system. This is acceptable to the company since it is confident that its internal computer experts have the abilities necessary to maintain the system.

The restaurant system is now being pilot tested on three sites. The benefits are already significant as franchise managers save 30 to 40 hours per week in administrative burden, thereby allowing them time to focus on other aspects of the operation such as client service. The system reduces the managers' time related to accounting, invoicing, shipping and developing statistics. Future modules are expected to reduce this burden another 50 percent to 20 hours per week.

One unexpected benefit from the new restaurant system is job enrichment. Now the restaurant jobs are perceived as non-administrative and provide an opportunity to use a new technology. The company believes this is a significant feature in being able to attract high quality employees to the restaurants, particularly in areas with full employment such as Toronto. The major complaint related to this component comes from the technical systems professionals who say that the users don't understand or appreciate the technological issues.

The benefits related to the central telephone ordering system were realized almost immediately, as the six part-time positions immediately became obsolete. All benefits are expected to be formally monitored and measured.

Conclusions

The company is satisfied that it has chosen and implemented the most appropriate system to meet its needs. The major 'adjustments' required during implementation involved:

- slowing the implementation to a pace which could be absorbed by the organization. The original plan was considered too ambitious;

- repeating the formal training for head office personnel to reinforce the new concepts, inform them on developments and help them cope with the temporary increase in workload while the new system was being implemented; and

- transferring the technology from the software suppliers to the company's staff. The supplier was not efficient and timely in these activities.

Case:	Company D
Industry:	Forest products
Size:	Approximately 200 employees at mill site; some $200 million in estimated annual production
Location:	Western Canada
System:	A quality control system

The Company

This western-Canadian owned and based forest products company makes a product that is becoming increasingly popular in residential and commercial building applications. The product, oriented strand board (OSB), is an extremely strong and less expensive substitute for the more traditional plywood panels. OSB is a poplar-based product, while plywood is generally spruce and fur-based.

The company sells through a number of large and small distributors in North America; U.S. sales account for some 85 percent of Company D's sales.

The company has two mills in the province. The newer mill, which contains the system profiled in this study, has been operating for 18 months. It is a highly efficient, fully automated mill — its 350 different motors are controlled by eight computers and by six program logic controllers. The daily output of OSB from the mill totals about $500 000.

The System

The system profiled in this study is a thickness and density-measuring device used primarily for quality control. The system uses gamma radiation and 'ultrasound heads' to read the thickness and density of each 4 feet by 24 feet sheet of OSB and to track the pressure and consistency of the pressing cycle. There are a total of 320 'readings' from each board and these produce thickness measurements to an

accuracy within 1/10 000 of an inch. The readings are monitored at a terminal in the control room and checked continuously for pressure, thickness and density.

The nature of the product, OSB, is such that accurate press performance is essential. Basically, the assembled collection of layered wood chips, glue and wax is given a heavy initial burst of pressure followed by several phases of gradually decreasing pressure. This produces a product with a hard outer shell and other characteristics that meet exact density and thickness requirements.

Through monitoring the characteristics of each panel of OSB, an aberration in thicknesses traditionally indicates a problem with the press hydraulics, temperature or other settings. Density aberrations indicate problems somewhere in the forming line or pressing process.

The Purchase Decision

Because the purchase of this system was part of an overall $65 million mill construction project, many of the factors that contributed to the purchase decision are difficult to isolate. Unlike the other cases, this installation was a proactive decision within a large mill plant construction, rather than a response to externally dictated pressures and situations.

The entire mill, including this system, is considered to be 'at the cutting edge' of forest products technology. The mill owner's conscious decision to be at the forefront was the main contributing factor to the purchase of this system. The mill has been designed with product quality in mind, and each equipment-purchase decision has stemmed from this 'quality OSB' goal. The sole owner of the mill made the purchase decision based on a number of considerations including discussions with his technical personnel, his previous experience with a similar system installation in his other mill, and his knowledge and active involvement in all procurement and design aspects of the mill as a whole.

The company had three general requirements when deciding to purchase a quality-control system. First, OSB, like other building products, must meet rigid quality and 'destructive' characteristics before being approved as an acceptable construction product. In Company D's case, for example, its U.S. sales must meet American Plywood Association standards, and the company must therefore maintain a database of laboratory test results. The Canada Mortgage and Housing Corporation also has standards stipulating that a certain number of tests must be conducted per hour and that the results of these tests be logged. The first requirement of the selected system, then, is that it must assist Company D in assembling and logging this database.

Second, while the lab tests are important for documentation and approval purposes, they are indicative of problems only after-the-fact. The company wanted a system that would allow it to act on the information by identifying quality problems as they occur. The aim was to reduce wastage, reduce costs and improve long-term customer satisfaction. The second requirement of a system, then, was that it must continually monitor the quality of the output.

As a final general requirement, Company D wanted a system that would allow the database logging of the performance of new chemicals and new materials in any experiments it may choose to conduct.

The Selection Process

The other mill owned by Company D was older and slightly smaller than the new mill and had previously installed a gauge for measuring the thicknesses of its OSB. This system used a laser beam method of measurement. However, the plant had many difficulties with the system, finding it difficult to keep calibrated and often producing unreliable results. Company D's original plan was to install the same system in the new plant. These plans were subsequently changed as the laser method continued to encounter difficulties.

The vendor of the system (referred to as R) ultimately installed in the new plant had been in contact with the mill owner during the mill construction planning stage. The vendor manufactures in a nearby city and had offered to install and write the software for a system for Company D. The fact that the vendor had successfully installed a system in Minnesota allowed Company D to make its selection decision with more confidence.

The flexibility of R's system also played a significant role in the selection. While the thickness and density-measuring characteristics were the main criteria, the system also had the capability to log lab test results and to direct signals and messages to the press rather than simply monitoring it. The selected system allowed the laboratory to advance from manually entering test data (which is done in most forest product testing, including at Company D's other mill) to the stage where test results are automatically filed into computer memory as they are completed.

In selecting the system, there was no formal cost-benefit analysis conducted. The system did not represent a major cost item for the firm. "It is a small but very important piece because of its value in the area of quality control and customer satisfaction." Furthermore, the firm feels that during the low periods, which inevitably occur in the forest products and construction industries, the higher quality products will continue to sell at the expense of lower quality, cheaper products.

Implementation

Company D handled most aspects of the plant construction and machine implementation itself. The firm's electrical and engineering personnel play quite prominent roles in the firm's planning as well as in systems and equipment implementation. In this particular instance, the vendor supervised the installation of the system's hardware, wrote the controlling software and provided Company D's personnel with the basic training.

On "a couple of occasions" during the implementation, Company D discovered that certain minor oversights had led to relevant information not being included in the system's output. In these instances, Company D would contact the vendor to discuss the possibility of including certain additional calculations on the reports. If it were not 'a big deal to have such and such included on the report', then the vendor would make the required adjustments to the system to include the desired output. The vendor was described as flexible and easy to get along with in this regard. In this manner, Company D was able to eventually accommodate any previous oversights. The firm feels that oversights are "inevitable with any system implementation"; one must rely on flexibility and tailoring to accommodate those areas where an exact match may not have been convenient or possible during the early phases of the implementation.

Currently, the system does not directly control the pressing aspects of the process. This linkage, wherein the press could be controlled through inputting settings from the terminal to the press, is described as being one which the company intends to pursue. It is "on the drawing boards." Under such a set-up, the four terminals that Company D installed could be used to input controls to the process, rather than to just monitor it.

Users

There was a minimal amount of computer knowledge required to learn and run the implemented system. Many of the users had no prior computer experience and only a minimal level of formal education. The control room supervisor was quick to pick up on the reading and interpreting of the monitor screen, while the two laboratory personnel also found the menu-driven system very easy to learn. The 'training' in both these areas was provided on-site by the vendor.

From working in previous mills and previous jobs, the lab personnel were already used to manually entering test data into the company records. This implementation simply eliminated the need for manual logging by having the test devices connected

directly to the new system. The result is that lab and other personnel can work more efficiently, directing time toward activities more productive than manually logging test results into booklets.

The computer logging of test results also allows the company easy access to past records should this be required. Future customer complaints, for example, could be referred, through the 'press load' number, back to the test results taken at the time of the output in question. The results would then be more carefully reviewed for inconsistencies. The process would eliminate the requirement of having to review "stacks and stacks" of paper, as is currently done at Company D's other mill.

Conclusions

The engineers and electrical personnel at Company D clearly play an important role in planning and decision making. The interests of those groups are not subservient to those of operational and financial groups. If anything, the 'quality OSB' orientation of the firm provides these groups with more input and influence than the operational groups.

The system implemented by Company D was very 'user-friendly'. The learning requirements were minimal. They represented very minimal change from the duties traditionally held by lab and control room personnel. Those changes that were introduced resulted in improved time usage by these employees. Company D requested that certain adjustments to the system be made by the vendor; these were minor additions to the output and relatively easy for the vendor to accommodate.

Case:	Company E
Industry:	Engineering consulting
Size:	Approx 15 employees; $1 million in annual billings
Location:	Eastern Ontario
System:	Coastal engineering models on a mini-computer

The Company

The company provides professional engineering services in the fields of coastal and ocean engineering to planners, governments, the oil industry, task forces and other types of clients. The company conducts feasibility studies, modelling, final designs, specifications and on-site observations for a wide range of breakwater, dam, offshore structure, shoreline protection, marina and waterfront development projects.

Since its formation in 1981 with a couple of professional engineers, the firm has grown to a staff of 13 and annual billings of more than $1 million. In recent years, an estimated one-half of the firm's annual revenue has come from U.S. billings, and the company has recently opened an office in the United States. International work also includes a recent project in Iceland. The company is based in an eastern Ontario city.

Given the professional nature of the business, Company E employs various PhD and Masters' level civil engineers and as such, the computer literacy at the company is fairly high. Nonetheless, there were still certain aspects of the installation being profiled in this study that required significant informal learning on the part of the users.

In addition to the system being profiled, the firm possesses a computer system for routine word processing and engineering calculations as well as three personal computers for basic calculations, word processing and engineering design. The company intends to have a PC for each engineer within one year.

The System

The company has developed state-of-the-art software for the numerical analysis of a wide range of problems that occur in coastal engineering projects. The analytical capability of the system includes hindcasting and forecasting of waves, shallow water transformation of waves, sand transport calculations, tidal hydraulics, overwater windfield definition and extreme value wave climate analyses. Information from the system would then be used in designing and modelling breakwaters, offshore structures and shorelines.

The Purchase Decision

Since its establishment, Company E had employed the services of another consulting firm to conduct its large-scale data processing. This company, fictitiously named GF, had nine employees and used its own mini-computer to conduct the processing for various clients, engineering and otherwise. The founder of Company E had used the services of GF during his previous line of employment and upon founding his coastal firm continued to use GF's services from 1981 to 1986.

Company E's engineers would physically drive to GF's facilities armed with whatever input data was appropriate for the task at hand. GF would then combine this data with wind data available on magnetic tapes and run the information through their mini-computer system. The cost to Company E for this service totalled approximately $2000 per run, while wind data plots and scatter diagrams would entail additional charges.

As Company E continued to enjoy strong growth through the 1980s, a concern began to develop among its personnel with respect to declining service from GF. Manpower at GF began to decrease, the firm was obviously having financial problems and Company E became increasingly concerned with its vulnerability to GF's declining performance. If GF folded, Company E would encounter a three- to six-month layover without adequate system support. This would cost Company E

future marine design projects, while causing significant problems with ongoing projects. Company E relayed this concern to GF.

Company E had a close relationship with GF since its infancy in 1981 and, in fact, during its first year had rented office space in GF's facilities. After moving into its own premises, Company E continued to give $60 000 to $100 000 or more in annual business to GF.

Engineers from Company E spent considerable amounts of time in GF's offices. As the problems developed during 1985-86, Company E's engineers became much more attentive to the how's and why's of what GF did with Company E's data via its mini-computer and programs. As Company E's decision to purchase its own mini-computer developed, the pattern of 'learning from GF' increasingly became a form of system training for Company E's engineers.

In retrospect, the founder of Company E felt that GF wisely and with subtlety led Company E to believe that the manipulation of data through the mini-computer system was complex and required years of training. Company E continued to take $5000 to $8000 worth of monthly business to GF until the deteriorating health of GF and other factors led it to make a purchase decision of its own. In retrospect, the system has turned out to be much less cumbersome than anticipated prior to the purchase, and any engineering fears regarding 'becoming programmers' have been unfounded.

As GF continued to encounter problems, certain key personnel left the firm. The situation was exacerbated by the concern that began to develop regarding the ownership of software. Essentially Company E designed and owned the coastal engineering software while GF owned the minor adjustments and 'little pieces' that made the software compatible with GF's mini-computer system. As Company E attempted to obtain backup tapes and other software held by GF, an indirect contact brought to its attention the fact that a cross-town structural engineering firm had a mini-computer and had been successfully running its own systems on the mini-computer for some time. The fact that another engineering firm had been

conducting its own analyses in-house, and that its engineers were able to handle the systems, was a significant motivating factor for Company E in leading to an eventual purchase decision: "if this engineer can run it so can we."

Company E was quite surprised by the amount of money they had been annually directing to GF. As there was no formal internal auditing, one of the engineers totalled these expenditures and the resulting $60 000 to 100,000 annual totals were higher than anticipated. As these amounts were usually directly billed to the client, it is understandable that the accumulated magnitude of the monthly sums may have escaped the attention of Company E.

During this period, Company E had been looking to garner a significant amount of work from a major oil company. Naturally, successful completion of this and other anticipated work in the petroleum industry could not afford the delays and unpredictability of not controlling one's own destiny. This was another important factor behind Company E's decision to purchase its own system.

In having a system to conduct analyses in-house, Company E could:

- avoid wastage of time in travelling to and from the facilities of GF;
- save approximately $100 000 annually in diverted billings;
- increase its computing and calculating flexibility;
- conduct the desired computer runs according to company's own priorities, timing and frequency;
- sell the in-house expertise to prospective clients in proposals and brochures;
- increase future strategic flexibility through alternate uses of excess capacity; and

- eliminate time wasted in explaining desires and goals to a third party.

At this point in 1986, Company E's decision to purchase had been made, and the selection process had begun.

The Selection Process

Company E estimates that it spent 15 person-days looking at different systems and the features and aspects of each. The company's founder had conversations with other companies, and with other vendors, which basically told him that "this and that vendor were great and their systems were great." While not integrally involved in the details of the systems, the founder had assumed the role of a 'champion'. He possessed decision-making authority and based the final decision on active input from various sources.

The software situation at Company E meant that the company had a relatively easy selection decision to make and the added discussions with these firms "gave Company E more confidence in its own decision." During its five-year relationship with GF, the company had developed a number of coastal software programs compatible with one particular type of mini-computer. The cost of rewriting this software to accommodate another brand of mini was estimated at $100 000, though certain Company E personnel felt that this could eventually stretch out to $250 000. Furthermore, there was a one-year time estimate associated with rewriting the software — a time delay the firm could not afford given its growing petroleum industry business. Thus, while the company felt that perhaps rewritten software could clean out a few bugs and hitches in the existing software, the situation dictated that it purchase a compatible system rather than rewriting to accommodate a new brand of mini-computer.

The company did not wish to enter endless debate regarding the appropriateness of the selected system: "it seems that with computers one can always debate this subject." Rather, the firm bought what was felt to be the most appropriate system

at the time. Throughout the decision, the firm's founder was in regular contact with the users. Essentially, the decision maker was not interested in the technicalities of the system and preferred to rely on the input from his 'hands-on' engineers with respect to the appropriateness, utility and ease of learning of the system.

Implementation

In implementing the system, the company was fortunate in having an informed outside consultant, formerly a professional programmer with GF, to help with certain aspects. The consultant had left GF a couple of years previous and was already very familiar with the mini-computer brand and with Company E's software. While of equivalent capacity, the mini-computer purchased by Company E was quite different from the huge system that had filled a room at GF. The consultant therefore was very busy during the early months in rewriting the bits of software to allow Company E to use its new system. Essentially the plotting, graphing and output formats had to be rewritten to accommodate a printer different from that which GF had used.

During the implementation process, the hardware vendor was extremely helpful in providing the use of its computing facilities while Company E waited for its own system to arrive. After Company E had received its system, but before receiving its tape reader, the vendor continued to allow Company E to use its magnetic tape reader. During this period, Company E had a heavy workload, and the use of the vendor's facilities and hardware allowed Company E to accommodate its workload on schedule. On one particularly busy weekend, the three Company E engineers most conversant with the coastal programs spent the weekend at the vendor's facilities entering project data and running analyses. Given the unique nature of Company E's software, the vendor's ability to offer system advice was somewhat limited — generally pertaining to hardware matters and a couple days worth of (marginally useful) system start-up advice. Knowing the nature of Company E's software, the former GF employee was most useful in facilitating a successful marriage between the coastal programs and the new mini-computer system.

The total implementation timeframe was quite short, about four months from serious purchase thoughts until full implementation and use. In retrospect, however, the firm felt that it should have had the in-house numerical and analytical capabilities all along, and it wonders why it "ever did otherwise." It seems apparent that inertia, an overestimation of the complexity of the system and (until later stages) a friendly relationship with GF clearly introduced a couple of years' delay into Company E's purchase decision. Shortly after the company implemented its own system, GF discontinued operations.

Company E never actually recorded formal purchase or implementation strategies. The heavy workload of the company precluded the establishing of a formal procedure — these were discussed and developed in a broad yet informal manner. The actual training of the users was also informal, derived partly from observing GF's activities and partly from 'the school of hard knocks', often indirectly at a client's expense. It is estimated that the three main users of the system required a total of 150 to 200 hours of informal self-training during the first year.

Users

In the two years since implementation, the new system has been heavily used. In fact, heavy billings to large clients allowed the cost of the system to be recouped in one year. Within 12 months of purchase, the firm had paid off its loan and, while no specific targets were established, this was certainly a shorter timeframe than had been anticipated by the firm.

During the summer of 1988, Company E will hire a summer student to do "software work" for the firm. This will include debugging some mini-computer programs and developing coastal software for the firm's personal computers.

While a small amount of analytical work may be adapted to the personal computers, these are not large enough to accommodate the massive calculations handled by the mini-computer. Strategically, this provides Company E with an advantage over

competitors who do not have similar capabilities. While the current project mix at the company has resulted in a presently underutilized mini-computer, it is anticipated that it will be billed out as often in the next two years as in the past. The company has yet to buy "a ready-made package" for the system. Basically each program requires significant tinkering and the company continues to engage its outside consultant when required. The cost of this service is estimated to total $5000 annually.

The company incurs an ongoing maintenance fee of $600 per month. For this, the hardware vendor's service people come on short notice to clear up any hardware difficulties. Company E attempts to recoup at least this amount in system billings each month, though obviously during busy periods billings far exceed this amount. From a strategic perspective, the firm has vague plans to branch into other water-related disciplines such as water quality and pollution dispersion. The availability and capacity of the mini-computer provides Company E with future flexibility should it choose to pursue these fields.

Company E hired a technician for a brief period to help with the running and debugging of the system. The venture did not work out, and the technician was subsequently let go. The firm has managed so far without the services of a full-time technician, and, while "one would have helped in busy times," the lack thereof generally has not presented any insurmountable problems.

An engineer who had joined the firm six months after the system implementation described the system and software as "not user-friendly." He felt that an important aspect of his learning process was the availability of prepared notes from other users within the firm. The existence of a bare minimum of information allowed this user to enter and 'play around' with the system — a method which he felt was the quickest way to learn and far superior to simply having a huge owner's manual. Currently this engineer, along with two other Company E engineers and the outside consultant, are all fairly comfortable with the system and with modifying the code as needed.

The users have had informal discussions regarding hooking the mini into the PCs, but it is felt that such a procedure is not yet cost-efficient: that there is not yet enough common data to merit the $7000 to $10 000 cost. The firm's word processing and PC systems are linked for word processing and laser printing purposes.

It was suggested that the company's computing procedures should be somewhat more formalized. For example, the mini-computer system records all errors and problems, yet no one within Company E reviews these records. Similarly, the backing-up of disks is done only on a random 'hit and miss' basis wherein some files are backed up and some are not. It is felt that all disks should be backed up on magnetic tape each week. To date, these procedural shortcomings have not led to problems for the firm.

Conclusions

Prior to the implementation, there were minor concerns expressed by the engineers that the programming and operation of the system may detract from their true roles, namely, engineering. In retrospect, this has not been the case. The system has been successfully implemented, and its capacity, combined with the users growing familiarity with it, has been a valuable addition to the firm.

In many instances of IT deployment, there exists a gap between the capability of the system and the requirements of the user, that is, a gap between the system knowledge orientation of the vendor and the specialized and technical requirements of the purchaser. In the instance of Company E, the smoothing of this gap was greatly eased through the use of an outside consultant who was well versed in both the mini-computer system and the firm's technical requirements.

There were many champions involved in the implementation of the system described in this case. The two largest shareholders and each of the users were heavily involved in the purchase decision as it developed, to the extent of specifying the

types of equipment and participating in the meetings with the vendor. While the small size of the firm partly required this to be the case, clearly the high degree of cooperation and communication among the firm's employees was also a major factor. The founder and major shareholder of the firm is not a hands-on user of the system. The fact that he recognized his limited knowledge of the technicalities of the system was also a factor in both the user-orientation of its selection and the ultimate success of the implementation. As mentioned earlier, the system was paid for in less than one year.

The company has yet to formalize the procedural aspects of the use of the system. It is possible that this random approach may be the best approach — indeed the company is not of a size that requires installing bureaucratic rules and regulations. At the same time, however, it has been mentioned by users that perhaps the firm should be better organized in the backing up of files and in the use of the 'bugs and problems' information that is documented by the system.

Case:	Company F
Industry:	Retailer
Size:	Approximately 20 employees; $2 million in annual sales
Location:	Eastern Ontario
Implementation:	A retail system to improve the purchasing, inventory control, sales monitoring and productivity

The Company

The company is one of the leading fashion-clothing stores in this eastern Ontario city. It sells a wide range of men's and women's clothing in its main store and footwear and leisure clothing in a recently opened franchised store. Both stores are owned by the same individual.

The main store has been in operation for 10 years, having originally opened in another location in 1978. Sales in its first year were around $250 000. The store had a couple of difficult years in the early 1980s when interest rates surpassed 20 percent and the economy and employment was stagnant. In retrospect, the owner also felt that store costs were not fully under control during this period. In 1982, the store closed for renovations, moved locations, and reopened with a bigger store in a prime downtown location. Since this time, sales at the store have been expanding by $200 000 to $300 000 per year to current levels of more than $1.5 million. There are 3 managers and 15 sales people employed by Company F's owner. The store deals with an estimated 50 vendors.

The rapid sales growth has pushed the store through a traditional pattern, that is, its founder and owner has increasing difficulty keeping track of things, purchasing is more complicated and demanding, staffing and accounting are more of an issue, cost pressures are increasing and capital requirements are also increasing. Clearly, in the mind of the owner, a computer system that could assist with these areas would be desirable and well worth investigating.

In 1986, the owner was awarded with a regional franchise to open stores selling shoes and related lines of leisure clothing. This was a very significant development for the owner, and it accelerated his thinking regarding the requirement for some type of computer system to assist him, not only in operating his own store but also in operating any franchised store that he may open in the future.

The first franchised outlet was opened adjacent to the main store in the fall of 1987.

The System

Company F implemented a packaged inventory and sales system for clothing stores. The package is run on a personal computer. The computer system can handle seven terminals, and, while only two have been deployed to date, future franchise outlets will be connected into the system.

The system has a capacity of 999 'categories', of which the main store filled up 380 and the new franchise will fill an additional 300. A pair of plain McGregor ankle socks and a large, red, Trekka shirt would be examples of 'categories'. The SKU number tagged on each article denotes its category. By punching it through the cash outlet, the sales clerk automatically removes it from inventory and records it as a sale under the particular category. By accessing the terminal, the user of the system could determine, upon demand, the exact number of any item held in inventory. Those items which are selling well, those which have been over-ordered and those which are out of stock or nearing depletion can all been identified quickly and to the level of detail involving sizes, colours and styles.

The system allows the company flexibility in a variety of areas. Items that are on sale do not have to be reticketed; rather, one sign would simply be posted in the area. By inputting the SKUs and day length of the sale on the terminal, the sale price will automatically appear on the cash machine when the clerk inputs the article's number.

Each regular customer on the firm's mailing list has been assigned a number, and the system, by inputting the customer's number, can be used to identify those customers who are seasonal, sporadic, sales chasers, have chequing privileges, owe money for 'layaway' articles, etc. Mailing lists can be printed in whole or tailored to particular customers.

Purchase order information is input into the system at the time of ordering. The volumes and dates of arrived merchandise is confirmed and input into the system at the time of arrival. The ticketing of the merchandise with SKU numbers is also done upon arrival. This aspect of the system then allows the user to identify those vendors that are slow in delivery or that are frequently delivering incorrect or substitute merchandise.

In inputting a sold article at the time of the sale, clerks enters their preassigned clerk number to access the cash terminal. This allows the system to monitor the individual clerk's sales per day, week, month and year, as well as the number of voids, the value of clerk purchases and other records. This aspect, then, is useful for employees on commission, for identifying those having difficulties with the system, and for other performance-related matters.

The daily sales summary, printed at the close of each day, provides a regular and immediate account of the sales, with a breakdown by cash, credit card, layaways and the final banked amount. This aspect will eventually be used for accounting and bookkeeping purposes, a task that is currently handled externally. Currently, the timing of the sales transactions is useful for identifying busy and slack hours and days. Staffing and lunch hours can then be planned accordingly.

The Purchase Decision

The decision to purchase a system was motivated by the owner's increasing concern with four problem areas: inventory management, cost control, ticketing time and staff assessment and control.

The rapid growth of the firm from 1982 to 1987 pushed it into a size range where the owner "couldn't keep track of each shirt and sweater." Costs, which had flared out of line in 1980-81, were threatening to do the same in 1987-88, and the owner felt that better control was required.

The store's acknowledged strategy of being in the fashion business ("make no mistake about it, we want to be the fashion store for men and women") pressured the owner into desiring a purchasing system that would more closely reflect the fashions and wants of his clientele.

The increasing number of the store's customers, whom the champion described as "educated, intelligent, tuned-in, information-oriented and demanding," suggested the need for a mailing list and customer relations system that could better inform the customer.

The owner's fixation on the two cardinal rules of retailing — "don't overbuy and don't overspend" — established the basic criteria for selecting a system. The inventory control aspect of a purchased system would have to allow him to better target future purchases and future vendors. The spending control aspect of a system would have to allow him to monitor employee performance, over-ordered items and customer preferences. Presumably, savings in the inventory and purchasing areas could be relayed into increased promotional and advertising expenditures — areas which, in the eyes of the owner, clearly lead to increased sales and profits.

The owner of the store had known an employee of a local computer retail outlet on a personal level for more than a decade, and the two had discussed possible computer applications informally for a couple of years. Basically, the store owner believed that as the business grew larger, some type of system would be required. The computer supplier had also briefly worked at the store in inventory counting, while simultaneously employed with the computer firm.

About the time that he was making his purchase decision, the owner was introduced through "the friend of a friend" to the main buyer of a large blue-collar oriented

clothing chain. This buyer had access to a computer system to assist with buying, and "seemed happy with it and used it often." This incident, while relatively insignificant, served to increase the confidence of the owner's belief that he should invest in a relevant computer system.

In 1986, the owner of Company F received the franchise rights for a popular chain of clothing, accessories and footwear stores and, by doing so, made the prospect of some type of system implementation much more immediate. The cost and usage of the system could be spread over two, three or more stores rather than just one. At this point, the owner had decided that the assistance of a computer system was required, and the task at hand was to select and implement an appropriate system.

The Selection Process

The owner of Company F was not particularly interested in the details of the system in question. The selection of the system did not involve extensive testing or comparing of various systems. Rather, the computer–consultant friend had come upon a U.S. software firm oriented toward retailers, and specifically their retail apparel programs, as a possible answer to many of Company F's needs.

The owner knew the consultant well, trusted him and knew that he would have the patience to teach the system to him. In the brief time he had spent talking systems with other potential suppliers, the owner had felt "stupid and intimidated." The owner asked the consultant to "install the system from front to back and to give me an all-inclusive price." The owner was quite conscious of avoiding a situation where he keeps spending, and was quite adamant that the one price include all that was required to perform the tasks identified by him in conjunction with the consultant.

The system price of just over $20 000 included the hardware, software and training. In selecting the system, time did not allow Company F's owner to conduct formal cost-benefit analyses or to support his selection decision with extensive calculations. He suspects that very few retailers could spare the time to conduct such analyses —

that, in practice, one would have to "take a deep breath and bite the bullet" on such decisions. His reasoning was that, while he may have been able to do without the system for some time yet, eventually he would save time and money with such a system. In this sense, then, it appeared wise to select and implement a system sooner, while the implementation was manageable, rather than later after another year or two of growth.

The owner's feeling during the selection process was that some type of government service wherein computer-system selection is simplified would be of great value to small business. He concurs with this feeling today, believing that other companies and individuals may not be as fortunate as he was in having a trustworthy consultant–computer friend to help him out.

The owner of the retail store takes a hands-on approach. He derives the most enjoyment from the selling and purchasing aspects of the retail business. As discussed in the implementation phase, the owner has hired an individual to operate the system. While the owner is attempting to learn the operations of the system to some degree, his main use of the system, and the perspective from which he selected it, is to use its output to help him in purchasing, inventory control, customer relations and staff productivity.

Implementation

Being the store's first experience in installing a system, the implementation phase encountered certain problems, some of which the owner feels could have been avoided.

The implementation process involved a significant amount of time and effort from the owner's perspective, more than he initially anticipated, and more than he could reasonably spare during the period in question. The requirement was primarily related to defining his exact needs from the system. While not of a system-technical nature, the requirements were nonetheless time-consuming, involving the

identification of colour, size, style, and vendor categories and codes covering some 60 vendors and 380 categories.

Compounding this requirement was the fact that he had decided to implement the system during the fall of 1987, the busiest time for retailers and, in Company F's case, the quarter that produces more than 40 percent of their annual sales. As a result, the implementation process dragged on for some six months. In retrospect, the owner feels that he should have delayed implementation until the slow winter months of January, February and March when it could have been handled quicker, at less cost, with less disruption and with the employees' full attention.

Because implementing the system also required the tagging of all merchandise with the proper codes, there were a few problems and mistakes made from human error and mistagging. Complicating this was the government-subsidized hiring of a placement student from a nearby college; this was not a success and ended up wasting a lot of the consultant's and owner's time. A lack of supervision on the part of both the consultant and the owner allowed a significant amount of information to be input incorrectly by the placement student. When the student finally did get 'up to steam' on the project, she left the firm.

Users

There is one small aspect of the system that will likely never be used. The owner prefers the service that he associates with hand-written bills and, as such, he will not use the receipt-printing feature of the new system. He also did not distribute the cash register receipts under the old system.

The main system user, aside from the owner, is an individual who has been hired since the purchase of the system. Her role is primarily one of accounting, customer services and systems implementation. As described, there are many purchasing, inventory, customer, salesforce and sales monitoring features to the system. This employee has been very important in gradually implementing certain features, that is,

In implementing aspects at a manageable rate. Having computer experience from previous jobs, she has basically learned the ropes of this system through using the manual or through phoning the consultant. She describes the system as "user-friendly" and of great long-term benefit to the firm. She has been involved in all aspects of the use of the system — including the word processing features for letters, mailing list features, inventory aspects, daily sales aspects and accounting and book-keeping features. She is currently in the process of transferring records from the accountant's computer to the firm's computer.

In the training of the clerks and department managers, she has preferred to work with each individually, in a hands-on environment, rather than in groups. She feels that this environment is more conducive to questions, answers and informal learning. The outside consultant, for example, held one session with all of the users, and she felt that very little of the information covered in the session with the consultant was retained.

The store in general retains a fairly informal atmosphere, with good staff relations. There has been no feeling of having a new system thrust upon them. Indeed, the staff has been very responsive and quick to pick up on the changes.

Until the clerks had become quite familiar and confident with the system, they were encouraged to complete the sale manually and to enter into the system the identification and SKU numbers after the customer had departed. This avoided the situation where the customer is forced to stand at the cash while the machine is beeping and not responding. Part of the learning process for the users also required that articles be tagged in an accurate manner. Whereas formerly an incorrect tagging meant simply that the customer entered the change room with an incorrect size, under the new system the SKU numbers would filter through from the cash terminal resulting in an incorrect inventory reading. Further training and increased understanding of the system has raised employee consciousness in this regard and these problems have subsequently declined in number.

Conclusions

This study profiles what began as a one-person retail operation and has subsequently turned into a rapidly growing fashion store. As the owner began to "lose track of each shirt," he began to feel that inventory and other aspects of store operation could be handled more efficiently with the assistance of a computer system.

While it is premature to classify the complete implementation, there were nonetheless certain factors that increased the odds of success. Some of the more important include:

- the computer–consultant friend of the owner who had good knowledge of the system and of the store;
- a willingness to 'bite the bullet' and implement rather than continuing to delay the purchase decision;
- staff attitudes, including the owner's, which were conducive to helping the integrator adjust and tailor the system to meet Company F's exact needs;
- an informal decision to implement the various features of the system at a manageable rate;
- time commitments from the owner toward defining what constitutes a 'product category'; and
- an informal, hands-on learning environment.

Case:	Company G
Industry:	Food processing
Size:	400 employees, 2000 customers
Location:	Eastern Canada
System:	Process data collection system

The Company

This company is a medium-sized food processing plant in eastern Canada. It has a large customer base, primarily in the Maritimes, but also in the rest of Canada. Its job is to process and package food and provide timely deliveries to its clients, while maintaining a reliable quality of product.

The company has several hundred employees, most of whom are unionized. The management structure of the organization is not large: the general manager works with five other senior management, responsible for the day-to-day production, shipping and marketing. The general manager is fully responsible for the company, reporting to the president who represents the private owners of the company.

The industry was not very active in the adoption of information technology. Some large national and international firms had installed very complex computer systems, but the large number of smaller companies have found it difficult to justify the cost of a large system. When Company G purchased hand-held terminals for the salespeople to use to report from the field a number of years ago, it was considered a very progressive step.

This company had purchased a mini-computer to run its accounts and ledgers in the early 1980s. This system has proved satisfactory, giving management a positive feeling for computer technology.

The System

Company G has installed a control system for managing its food processing plant, to control costs and improve the management of the shipping area. The system codes and identifies the product as it moves through the process and uses electronic weigh scales to assess production. The same system monitors the output of each employee and is able to quantify the output per person-hour.

The Purchase Decision

Company G had for many years tried to develop some kind of relationship between the time clocked by its employees and the amount of food processed by the plant. Its attempts had not led to success because, although it was possible to match total salaries to total output, there was no way to break this down into its components, to be able to tell specifically what the problems were. As a result, management was not able to act on any of this information.

The senior management had a suspicion that there was a lot of employee time wasted in slow returns from breaks and trips to the washroom, but there was no way to tell this. Yet the costs of this time could be significant. The company had a consultant profile the operations. The results suggested that considerable savings could be made if productivity could be raised by only five percent. Unfortunately, the consultant did not identify the way the savings could be achieved.

The shipping department deals with more than 1500 customers, many of whom get small shipments at least once a week. This requires much work from the shipping department, not only in moving product but also in documentation. This company delivers its invoice with every shipment, involving as many as 1000 invoices a week. There was a traffic jam at the loading bay, as the company could load only one truck at a time, and there were many orders, invoices and trucks waiting for attention.

The general manager decided that a new computer system was warranted. As an accountant, he had sufficient exposure to computers to understand the tasks a computer could do, and he was able to decide that there was a computerized solution to the firm's problem. The general manager was convinced that there were significant savings to be made with some kind of computerized information system; it would be a matter of finding a system that would do what he wanted, at a price that seemed reasonable.

The general manager asked each of the 15 department supervisors to put together a list of the kinds of information which they would find useful. These lists became a master 'wish list', which helped in the system selection. While the company has no explicit technology plan, this list has formed not only the focus for the implementation discussed here, but the basis for later installations.

The company was unable to use traditional cost justification because it was not easy to see what the value of better information would be. Human resources costs were the second-largest expense for the company; if it were possible to reduce them in some way, the savings would be great, but the management could see no way of putting a dollar value on that saving in advance.

The Selection Process

The general manager prioritized the processes which would use the technology. He and two other managers, the MIS manager and a production manager, did a tour of the companies that might be able to supply the hardware. The managers were clear that they needed a system based on weigh scales, because their production was measured on the weight of food coming in and the weight of processes and packaged food going out. This tour of the hardware companies made it clear that there existed no system exactly suited to their needs. They decided to select one hardware company and develop the software in-house.

The managers had dealings with companies supplying scales for many years, and had a feel for the best companies in that business. The supplier finally selected offered the best combination of price, performance and support. The MIS manager was to be responsible for the software development, so he was able to ensure that the hardware would provide the information and support needed.

The system uses 30 electronic weigh scales to monitor the volume of food processed throughout the plant, from deliveries through each process to shipping. The system also takes input from each employee, so that the production is linked to an individual's performance. A new mini-computer was purchased to maintain and support the data. Bar-code readers were used to identify each item being processed and each employee.

The system selection took about six months and was considered in hindsight to be the easiest part of the entire process for this company.

Implementation

The company had expected that the implementation would take about two years; in fact, it has taken the company about three years to get the major components of the system up and running. Indeed, the process is still going on, as new parts are added and new needs are appearing that might be met by this system.

The MIS manager hired two people to work with him on the software development. These additional salaries, and the associated support and maintenance costs, were part of the ongoing cost of the system, because the staff would be needed not only to develop the system but also to support it in the future. The in-house software development was necessary because the company felt that it needed to get a system which met its needs exactly; it had to be a custom fit of information technology to their manufacturing process. The customization took much longer than expected because of endless work on details. In hindsight, this was not regretted, because the system worked well in the end. If he were to do it over again, the

general manager has stated he would recommend using some kind of packaged approach instead of taking on all the headaches of developing a new system.

When it came to getting the system up and running, the management decided to set up one department as a pilot project, to test the system, and to help the users to get used to it slowly. Although the MIS manager called this a pilot project, he was clear that the system had to be working almost perfectly before the pilot started, so as not to destroy credibility for the system early on. The purpose of the pilot was to help the users, not to assist the system developers.

Once the development work was done, the pilot phase and the rest of the implementation went very smoothly. Having the direct involvement of the General Manager was a major factor in making every employee take the system seriously and make an effort to ensure that the system worked.

Users

In planning the installation of the system, once the software was ready, the company considered the needs of two groups: the supervisors and the union workforce. Management did not anticipate any strong reactions against computer technology from either group, so the planning involved introducing the staff to the equipment and explaining the new procedures to them.

There had been some problems with the union in recent years, and management had historically taken a strong line with them. The most recent confrontation had ended with the management in a very strong position, so in planning this implementation, the management anticipated no real difficulties. Since the system involved the monitoring of the activities of each union employee, there might have been some conflict. The implementation, however, was supported by the workforce, and no personnel problems were experienced.

The shipping department was used as an example of the process users went through to become accustomed to this system. The shipping department was a serious bottleneck in the output of the company, because it used only one conveyor belt and could only serve one truck. The supervisor could see that it should be possible to serve up to five trucks at a time, if the conveyor belt could be scrapped and a new system installed. An impediment to any new system was the existing manual system of producing invoices and the requirement that every shipment be accompanied by the invoice for that shipment. It was hoped that the new system would also improve problems the firm had been having with order substitution and with back orders.

A new system would have to provide some way of identifying product and linking that identification to a fast invoice-processing system. One long-time member of the shipping staff said that the old way of shipping, using two-wheeled carts, was much more efficient than the current conveyor belt. The company agreed and decided to go back to that system, but with a different monitoring system. Each product ready for shipping would be read by the bar-code reader and allocated to a shipment. Once a shipment was ready to go, the invoice could be prepared quickly.

Shippers would have their own personal bar-code read into the system when they came into work. At the end of the day, there would be a summary of the work each had done, and it would be clear if any one person was not performing to target.

The changeover, from the old system to the new, was done slowly and involved only a few workers at first, and then more as they grew accustomed to it. The implementation was done in three phases over the course of six to eight months. A pilot phase took four to five weeks, during which both the old and new systems were running in parallel. This was followed by a two-month trial period for the entire shipping operation, but with the old system still in place. There were some bugs to be ironed out, and the old manual system continued to be run a few times a week to test for problems in the new system.

It took about two weeks for a user to become comfortable with the system, after which it would become second nature. It had been seen as important to make the system user-friendly so that users could be functional on the equipment very quickly. This appears to have succeeded. The supervisor reported that there were frequent discussions with the shippers to explain the changes and to prepare them for the new system. The system is actually operated only by the supervisor and the checkers, and not by the staff moving the product, so the training required was only for a few staff.

The staff of the shipping department are very pleased with the system. The supervisor, who had had no previous exposure to computers, now has a terminal in his office and cannot imagine working without it. His staff are eager to see their results at the end of the day, and there is some competition to see who does the best. The system has made their operation much more efficient. Since installing the system, they have increased the amount of product shipped by 59 percent, measured in pounds per person-hour. They are able to monitor performance and manage the shipping process in a much more capable way. They consider the implementation a success and are already planning for further improvements to their operation.

Conclusions

There are two aspects of this case that have had a significant impact on the success of the installation. The first is the role of the 'champion'; in this case, the general manager takes almost all the credit for deciding to go ahead with a system and for selecting the system. This individual influenced the implementation and ensured that the users made the effort to get the system working. This level of attention was a key element in the success of this system. It required a lot of time and personal commitment which would be difficult to give if there were other pressing matters requiring attention. The role of the MIS manager was important only in the implementation phase, and even there, the influence of the general manager continued to be strong.

The second aspect that drove this installation was the conviction that there would be major cost savings from the new system by more efficient monitoring and management of employee time. The general manager admits that no real analysis was done on this before the installation, but he was convinced it would be so. The company now believes that it is more cost-efficient and better able to compete against larger food manufacturers in Canada, and that it is able to increase its exports. Recent improvements in the company sales, particularly in export sales, have been attributed to the fact that the company has installed this system. The company believes that customers respond positively to a company showing computerized invoices and statements.

It is surprising that so little explicit planning went into the purchase decision and the system selection. The general manager must have had a very clear vision of the system needed when he made the tour of the suppliers; such a vision was unusual in a marketplace where the system did not in fact exist.

It was also rare to find a union shop that had so little difficulty in implementing a system to monitor union members' performance. The company did not consult with the union beforehand, or even during the system selection. They simply introduced the system to their employees as a *fait accompli* and showed them how it would work. There is no evidence that this has caused problems for the company.

Case:	Company H
Industry:	Financial institution
Size:	100 employees
Location:	Central Canada
Implementation:	Processor and terminals for in-house processing of financial transactions

The Company

Company H is a relatively new financial institution in central Canada employing about 100 people. The firm's deposits consist of fixed-term Canadian business savings, retirement savings and business demand-deposits. Its loan portfolio is directed toward commercial borrowers, residential mortgages, and the construction, real estate and energy industries, in that order.

The System

Since receiving its charter, the company has used an outside service bureau to handle its computing. The service bureau provided computer services to a large array of independent customers including credit unions, and to a lesser extent, banks. This service bureau was originally formed as a provider of computer services to libraries and financial institutions.

Company H relied upon the bureau to conduct all of its general ledger, transaction, interest rate and other calculations for its mortgages, retail accounts, loans, RSPs and term deposits. The company owned a processor and certain tape drives and terminals compatible to the bureau's systems. In addition, the company had 70 to 80 personal computers for use in its offices and branches.

In early 1987, rumors of financial problems at the service bureau began to circulate, rumors which became fact with a May 1987 announcement that the bureau was

being put into receivership. Company H had to immediately start the process of searching for a suitable in-house system to allow processing of the required financial information.

The hardware system that was ultimately purchased and implemented in May and June of 1987 was a mini-computer, combined with a software purchase from a subsidiary of a major Canadian bank. The hardware purchase was a minor aspect of the implementation. Company H was comfortable with the selection of hardware and its operation, but its knowledge of the software was virtually non-existent. The installed mini-computer currently handles 90 terminals in many central Canadian branches, while the tailored software programs allow Company H to conduct all of its financial transactions and computations.

The Purchase Decision

After becoming aware of the bureau's difficulties in March 1987, the company made a very rapid decision to install its own on-line computer system and therefore gain control over its own operations. Given a creditors' date of May 31, 1987 to determine the bureau's fate, the company established a conversion date of May 31. The selection process commenced with the goal of "a low-cost conversion that will allow us to offer the same products after the conversion as before."

In retrospect, Company H estimates that conducting the computing in-house saves approximately 30 percent annually over the service bureau's costs. Company H had been somewhat concerned with the 'nickel and dime' type service charges and rental charges that the service bureau seemed to be applying with increasing frequency. The in-house system also provided Company H with added control over its data processing and flexibility to specialize in additional products should these products be felt desirable in the future. This combination of cost saving, better control and an improved level of service has made the company very satisfied with this installation.

Despite the apparent benefits, Company H feels that it would not, even today, have made the switch to in-house capability were it not forced. The associated inertia, the training logistics and the capital costs of around $200 000 would likely have combined to make such a changeover undesirable, particularly during a difficult economic environment.

The Selection Process

An aspect of the company's informal technological plan was to acquire generic products, where possible, to ensure flexibility to meet whatever unforeseen changes may lie ahead. While not a revolutionary strategy, it did serve the company well in its hardware selection subsequent to the service bureau's problems. In selecting a generic mini-computer, the company's 90-plus personal computers and its controller could be integrated with it. As a result, the company was forced to divest only the 18 terminals and associated processor that were used in conjunction with the service bureau.

The hardware purchase in this particular instance was described as being "minor, almost irrelevant," as the selection decision was almost entirely software-driven. Selecting the most appropriate software and having people with the ability to tailor the software were the key elements of the selection process.

Given the sudden circumstances that forced the company into a decision, it is not entirely correct to state that there was a 'champion' of this implementation. There was one individual, the assistant vice-president in charge of the systems group, who took a clear lead in selecting and implementing the system. After the chief executive of the company made a decision to purchase a system, this individual conducted a preliminary survey of all relevant software available from North American vendors. This list was reduced to a reasonable number that were felt to be those providing systems closest to Company H's user requirements. Given the nature of the American banking industry, there were a great number of U.S. firms offering software to the financial industries and some of these were included on

Company H's list. There were also a few Canadian suppliers on the preliminary list.

To accommodate the selection and implementation processes as smoothly as possible, the company established a conversion committee comprising representatives from all branches of the firm. These individuals — representing the consumer, commercial, retail and central processing areas of the company — maintained regular contact throughout the three-month selection, implementation and training period. The meetings served to bring out the concerns of the representatives, while also keeping all parties informed regarding where things stood in the process. Part of the rationale for establishing the committee was that the 'champion' should not merely attempt to anticipate the concerns of each representative but should also hear them directly in an open and informed atmosphere. The immediacy of the task at hand also was a significant factor in "pulling everyone together" and focusing efforts. These meetings were considered to be an important mechanism in the success of this implementation.

The assistant vice-president, in short-listing the supplier firms, was forced to eliminate virtually all of the U.S. bidders for two reasons. First, the timing requirement of three months was the fundamental criterion, one to which many firms could not commit. Second, familiarity with the Canadian automated banking machine (ABM) system was imperative given Company H's growing use of ABMs in its own facilities and in those through an agreement with a major Canadian bank.

The assistant vice-president prepared a short-list of three firms with cost-benefit estimates for each. The limited time availability ("a couple of weeks") prevented the gathering of sufficient information from the vendors to quantify these bids with any degree of accuracy. The analysis was of a general and qualitative nature. Time and other constraints hindered the formulation of detailed cost-benefit analyses.

The users of the system were involved throughout the selection process, both through the conversion committee and through less formal communication. Users examined each system for closeness of fit to their requirements and to better

understand the changes in processing and reporting that would be associated with each system.

The system that Company H selected was a packaged version of the banking system used by a major Canadian bank. The selection was based on the two reasons mentioned. First, the software implementation could meet the three-month deadline. Second, the package was reasonably close to Company H's needs and, more important, the software team had a superior knowledge of the Canadian banking scene, which allowed it to accommodate the system to meet Company H's exact requirements. Included in this latter criterion was the excellent ABM knowledge possessed in particular by the head of the software team.

The executive committee of the company concurred with the assistant vice-president's recommendation and selected this system.

The system was not a perfect fit and certain characteristics of it, particularly the 'front end' data entry aspects, were more cumbersome than the previous bureau system. The new system required more manual inputting of general ledger information than did the old system. There were two other hitches that had to be accommodated. First, the manuals available from the supplier did not exactly correspond to the system that Company H received, thus requiring those most involved in the implementation to prepare tailored operating instructions for each branch and user. Second, the system simply "did not work" in certain areas. For example, certain aspects of the teller balancing program had to be adjusted and adapted by the supplier, initially just to make it operational and finally to allow it to meet Company H's exact requirements. In this regard, the supplier personnel were "extremely helpful, patient and knowledgeable."

Implementation

The timing of this particular implementation did not allow for the ability to run both old and new systems in parallel for a period. The old system was used until the

Friday the financial data was converted and entered during the weekend, and the company opened with the new system on the Monday. The non-financial data (such as account type, name, address and date of account) had been entered during the three previous weeks; term deposit information, being more stable, had also been entered prior to the last weekend. The requirement to include the most up-to-date information demanded that the other financial information not be keyed into the new system until after the close of business on the Friday.

Given the relatively tight financial situation of the company, there was an attempt to structure the system purchase such that its monthly costs would be in line with the amounts previously spent for the bureau's services. The overall implementation, though unanticipated in the budget, was quite manageable in terms of the capital cost and training requirements. It was a priority of the company that the system be small enough to be manageable within the three-month timeframe dictated by the external pressures. The company wanted to be able to keep customer disruption, employee training and personal adjustment to manageable levels.

When the in-house system was operational, the company removed the 18 terminals and processor that had been used with the former service bureau system.

While the company had an established and written implementation plan documenting the various training and timing details, it was constantly adjusted — "Is there ever a plan that is not rewritten 15 times?"

Users

In an operational sense, there were various adjustments to be made by company personnel. Because Company H was now conducting the processing in-house, it was necessary to hire and train two staff to handle the processing through the night. The report printing and auditing procedures were different under the new system and training was required in these areas. Despite the training effort, it took one to two months "to settle things down" and to get all aspects of the new system and

operating procedures back to the state they were in when using the service bureau. Training was an important factor in getting the users comfortable with the new system.

Once the system was selected, two individuals were sent to Toronto for one month to become familiar with the system. Five individuals went for a shorter period to obtain manuals and to review them with the designated representative from the software supplier.

During the implementation, Company H's representatives spent some six to eight weeks in regular contact with personnel at the firm supplying the software. This length of time was required by both the vendor and the company. The vendor was integrally involved in tailoring the system to meet Company H's desired controls and parameters (these would include Company H's service charges, interest rates, compounding frequency and other variables), while Company H was involved in learning the system and in assisting with the tailoring of it. The company also hired two experienced processors to handle the overnight processing on a permanent basis — hirings that were part of the decision from the earliest stages.

Much of the training was conducted during quiet periods in the morning when one or two individuals from each area could work in a hands-on manner with the terminals with the assistance of the most knowledgeable systems people. Training was also provided six weeks after the conversion over a month-long period. Individuals were brought into training headquarters one at a time for retraining in all aspects of the system.

During the training period, the company encountered several expected problems and hitches. In general, these were associated with the processing, such as the daily auditing of reports and the filling out of new forms by the customers. The problems were not related to any psychological resistance to change — indeed, the company found that the employees were very keen on accommodating the new systems and on ironing out the difficulties associated with the new procedures.

The informal work environment of the company, and the existing good staff relations, were integral parts of the successful implementation of the system. Significant overtime was required during the data entry and conversion stages of the implementation, and the staff were extremely cooperative — partly out of dedication and partly out of recognizing the immediacy and urgency of the situation.

Conclusions

This case profiles a new company, still in its infancy and growing at a rapid rate. Like many small financial institutions, the company contracted outside computing services to save up-front money and eliminate certain hiring and training requirements. To provide these services in-house "takes time, money and people. We had a surplus of none of these things."

The company was forced to take these services in-house much earlier than it would have without the unexpected external pressure. The time spent learning the new system was at the (as yet unquantified) expense of business development and other valuable activities.

There was significant change associated with this implementation, from the teller to the processor and from the administrator to the customer. A number of factors contributed to the success of this implementation, including:

- the manageable size of the system;
- the conversion committee, representing all departments and branches of the company;
- the smallness, informality and employee relations of the company;
- the focused approach of the committee as a result of the immediacy of the implementation;

- the existence of a vendor willing to sell a closely matching software system;
- the existence of vendor personnel sufficiently well versed in the client's needs and the vendor's product to be able to take a lead role in marrying the two;
- the one or two key company personnel willing to take charge of effectively promoting, selecting and implementing the system;
- a sufficiently flexible implementation plan to accommodate the inevitable changes; and
- sensitivity to customer aversion toward new forms and other changes.

Case:	Company J
Industry:	Fish processor
Size:	300 Employees; sales of approx $15 million
Location:	Eastern Canada
System:	PC-based payroll and inventory system

The Company

Company J is a small privatelyowned fish processing plant in eastern Canada. The company has about 300 seasonal employees and only four full-time managers. The president owns the majority of the company and is ultimately responsible for the operation of the company. The general manager is responsible for the day-to-day operations, assisted by two other managers, one covering purchasing and another covering general management.

The company is growing steadily, but the industry is very competitive, requiring acute cost control and a consistently high quality of output.

The System

Prior to the purchase of this system in 1986, the company had no experience with information technology. Company J bought a personal computer system to automate a manual payroll system and to manage its inventory. The total system price was about $7000, about two-thirds of which was for hardware.

The Purchase Decision

In 1985, the president decided that a computer system might help them in running their payroll more efficiently. At the time, the payroll was a full-time job for one

person, producing weekly pay slips for 200 people, each of whom worked different hours and had different deductions, and included both piece-work and bonuses.

The inventory was also handled manually, involving a physical stock-check every week. Up-to-date information was required on the volume of stock and its quality, to fill orders that come in by telephone at any moment throughout the season.

There was some competitive pressure in the purchase decision, in that the president realized that any cost advantage he could gain would give him a stronger bargaining position with his customers. Only the largest national companies in this industry had any computers; small companies such as Company J were unable to justify the investment. The president believes that the benefits of such an investment are not clear to his immediate competitors.

The assistant general manager joined the company at this time, having recently completed an engineering program at university. There is not complete agreement about who talked whom into purchasing a computer, but the president and the assistant general manager between them agreed that a computer would be a big help. The assistant general manager had some experience on computers at university, so was considered the resident expert for this implementation. One of his first jobs on joining Company J was to select and install a system to automate the payroll and manage the inventory. Up to this point, no other member of the staff had been involved in discussions about this system.

The Selection Process

The president and the assistant general manager attended a technology show at the local university, at which personal computers were displayed. Several business management software packages were being offered, but there was only one Canadian payroll package. The president had set himself a ceiling price of about $10 000 for the entire system, so only systems which might fall within this category were considered.

No cost evaluation was done to see what might need to be spent or what value might be gained by such an investment. This process was thought to be too difficult. The figure of $10 000 was considered to be affordable for the company.

Following this technology show visit, the assistant general manager looked through several computer magazines and trade journals for appropriate software. He realized that the software purchase was going to be the key decision and that the hardware should be bought to support the software. The new computers he had seen at the technology show appeared to have a large enough memory to handle the software he thought he needed.

He then made appointments to see staff at three established computer retailers in the nearest major town. He asked about the software packages for payroll and inventory control; he got proposals from all three companies, covering cost, installation and servicing. The company that was selected offered the best price and also had the most conveniently located service depot.

Implementation

The computer retailer delivered the hardware and software, and set it up one afternoon. The assistant general manager then sat down with the manual to teach himself the system. It took about a week to master the system, but he had no other responsibilities at this time. After discussions with the person who handled the payroll, he set up the payroll system and did trial runs to confirm that it would work.

The Payroll System

The computer retailer gave a brief tutorial on the operation of the system to the company staff, but this focused on the hardware rather than the software. Little was retained from this session, because most of the concerns the staff had involved the software. The assistant general manager then brought in the person who handled

the payroll and taught her the operation. This person had used computers in her previous job, so she did not find it difficult or intimidating.

The first job was to input all the data on payroll from the start of the year so that the system could do cumulative totals. They started using the system on a small portion of the payroll and ran the old and new systems in parallel for several weeks, testing for results and reliability. Following the success of this trial phase, the full payroll was set up and run. The staff checked everything carefully for a few weeks to ensure that it was going smoothly; there were no problems, and they switched over to the new system.

This process took much longer than they expected. Getting the historic data on the system and testing the new system with the data to make sure it was correct were time consuming tasks. Both the assistant general manager and the person responsible for the payroll were enthusiastic and willing to put in the time because they were confident that the result would be worth it.

The implementation of the payroll system is considered a success. The payroll now takes only one day a week (as opposed to four or five), allowing the payroll person to spend more time handling other administrative tasks. The company has increased its staff by 50 percent in the last two years, yet the administration required to handle those employees is less than it was.

The Inventory Management System

The inventory control system was installed once the payroll system was up and running. The assistant general manager picked a junior member of the shipping and receiving staff who agreed to be trained on the system. This system involved a different way of working for the shipping staff. The information that they used every day was generally required by the general manager on a regular basis. He needed to know the stock on hand to know if orders could be filled.

The inventory system was unsuccessfully implemented. The general manager, who required the information, did not trust the system and did not have the time to get used to it. The shipping staff were jealous of the junior member who was selected to run the new system and were not cooperative. This position was reinforced when it became clear that the general manager did not use the new system.

The benefits of the new system were not clear to the users, so there was little incentive to change from old established methods. If the general manager had supported the new system, the employees might have made a greater effort to adapt; without that support, there was no incentive to change. As a result, this part of the system has been abandoned.

General Accounts

As a result of the success with the payroll system, the company has invested in a general accounts package and has started to implement it gradually. While the three people who run the office are now all comfortable with the computer and are able to operate the accounting package, the general manager has no faith in the new system and insists on old manual records being kept of all transactions. The office staff, however, recognize the value of the new system, in terms of time saved and efficiency, and are hoping that the manual system can be phased out once the new package has proved itself.

Quality Control

At the same time that the computer was being installed, the company had a summer student placed with the company as part of a job-creation program, to help with quality control. This is an important part of the plant's operation, yet it had not been a clearly-defined task until recently. A manual system was set up three years ago to sample the meat at every step in the process, and a random sample of the finished product for colour, weight, taste and odour. The ministry sends a representative to

test for bacteria levels every week. The purpose of this program was to increase the overall quality of production by reducing the amount of wastage from spoiled meat. If the company could guarantee a higher level of quality, it could sell more and sell at higher prices.

All the data from the quality control tests are recorded on paper. Last year, the assistant general manager created a database for this data to produce summaries of the changes in quality and the aspects that required attention. It took an enormous amount of time to input this data, but once it was there, the graphs and charts it produced were very revealing. Management looked at these at the end of the season as part of its analysis of the firm's performance for the year. The following year, it was thought that it would be useful to have regular reports during the season. This was not thought to be sufficiently important to pay someone to do, so no time was allocated to getting it done. The little time the summer student had available to work on this was at times when the computer was busy with other operations.

Users

The users of this computer fall into two groups: those who support it with enthusiasm and those who have no use for it. The former group has been successful in getting the payroll implemented because it had no impact on the latter group. In other areas, where the latter group has been involved, little headway has been made. The general manager sees little benefit in the system, and has no time to devote to learning it himself. Other members of his staff, who share this attitude, see no reason to change their ways.

Few of the users were involved in the selection or implementation process. It appears that the president said that a computer should be purchased and that the operation of the computer was not thought to be important enough to warrant much planning or discussion. Support for the users is provided by the assistant general manager, when necessary.

Conclusions

There are two aspects of this installation that might have been undertaken differently. The first is the needs assessment. If more work had been done on an identification of the needs to be met by a computer system and the benefits that the computer might bring to the operation, then it might have been easier to sell the system when it came to implementation.

The second part of the installation that might have benefited from a different approach is the handling of the users. These users were not involved in the discussions that led to the purchase of the system, and consequently they did not have any ownership of the system. When it was installed and offered to them, it was not clear what would be gained by changing from an established and familiar system to a foreign system. Without any ownership or clear incentive, the users had little interest in going through the aggravation of changing their operation.

The assistant general manager, as 'champion' of this installation, was in a good position to implement an administrative system that did not affect other members of the company. It appears that he was not in a good position to make managerial changes, without the explicit sanction of the general manager, either because of his junior position or his newness to the company.

Case:	Company K
Industry:	Aerospace
Size:	3000 employees
Location:	Ontario
Implementation:	Micro-graphic system and database for design documents

The Company

This is a medium-sized aerospace company, owned by a foreign multinational corporation. The Canadian operation is responsible for the manufacture of advanced electronic components. Company K does some of its own design work, builds to designs from the parent company or builds to specifications set by other companies. Generally, the company builds a full range of products, from individual, customized products to mass-produced components. In every product it manufactures, there is a large proportion of foreign components and materials. Its customers are throughout Canada and elsewhere in the world.

The company deals in advanced technologies but does not see itself quite at the 'leading edge' in the use of these technologies. Company K works hard to keep up with its parent and with other companies in the industry. It has a staff of over 3000 employees in Canada, a large proportion of whom are engineers involved in design and manufacture. The company has experienced remarkable growth over the last nine years, increasing its staff by almost five times over this period. These staff are spread among about 10 different buildings scattered over a large suburban part of southern Ontario.

The System

The company has invested in a micro-graphics system to store, copy and disseminate design documents. The company takes a finished design and stores it on microfilm. Microfilm copies are distributed to several departments in the

company, and hard copies are made only when necessary. Company K has also developed a database containing information on the drawings, accessible throughout the company.

The Purchase Decision

Much of the business of the company involves the design of new products, often using resources in several different departments. Engineers need to know where they can get the drawing and be sure that they have the latest version of the drawing they want. Sometimes hundreds of copies of a drawing are produced for the different design and production engineering departments. On the old white print machine, the reproduction of these drawings was both time consuming and expensive. If there was a request for an immediate copy of a drawing, the system simply could not handle the demand. Designers and engineers became impatient.

The master drawing is kept centrally, with a back-up copy stored on microfilm at a separate location. To support the remote users, the central office sent white print copies to the various 'print cribs' in the company; these print cribs are storage rooms, used to keep copies of all the designs. Many of the cribs were not staffed, and any information required on the drawings had to be obtained from the central office. The central office kept a Cardex file on every copy of every drawing; this had to be maintained for all drawings going back many years. The local cribs had no way of keeping track of the revision status of the drawings, so engineers were unable to tell whether the drawing they had was the latest available or, if it was not in the crib, who had it. In addition, each crib received copies of all drawings. There was no estimate of need, so the cribs were full of documents, many of which were not being used.

Company K is always concerned with security of information. It needs to be able to assure its customers that all information is kept securely. Except for the making of microfilm back-up copies, which was done by a separate company, the documents never left the company's premises.

The two factors that encouraged the consideration of the purchase of a new system to cover this operation were the time lag in providing information on technical drawings to the user community and the cost of producing hard copies of these drawings. As a result of growing dissatisfaction from the users about the efficiency of this service and increasing costs, the management decided to look for an alternative system.

During the 1970s, the culture of independence within the company allowed the introduction of a number of incompatible systems in different departments. By the early 1980s, Company K had several mini-computers, from at least four different manufacturers. The MIS group had not been able to control this growth, so some managers formed an Information Resource Management (IRM) committee to combat the growth of independent systems. This group has input from the MIS group, but is not responsible to the MIS group for its actions.

There is no explicit technology plan for the company. Each department prepares requests for all capital equipment purchases, complete with a cost-benefit analysis. There are some standard forms for this process that may be used. Although a financial analysis is required, non-quantified benefits may also be included in the evaluation. The division collects these requests and makes an application at the corporate level for funding. Money is allocated to the division to divide up between the different projects as it considers best.

Once a manager has been given the funding for a particular purchase, then the request goes to the IRM committee for discussion. This committee concerns itself with such issues as compatibility to ensure that those systems that need to be compatible will indeed be so. The committee was responsible for the coordination of a number of investments in new technology, such as the fibre-optics network linking all the company's buildings.

The manager of engineering administration identified a micro-graphics system, coupled with a database, that would meet most of their needs. The manager

believed that the system would be considerably less expensive to run, and would be able to respond to requests more quickly. The system would demand a reorganization of the management system for engineering drawings and the development of a new approach to the crib system.

The Selection Process

A team of people was formed by the manager of engineering administration, including himself and representatives of the department that managed the printing and dissemination of drawings, and the operations division, representing the user community. This team set out to decide which microfilm system would best meet their needs.

The group went to several other companies that had microfilm systems in operation to see what their systems could do and benefit from their experience. This research, together with some reading on the subject, allowed the team to identify three leading suppliers of microfilm systems that might meet their needs.

The team established four main criteria for evaluating the systems offered. These were cost, print quality, speed of copying and the availability of complete preventive maintenance. The suppliers were told what the company's requirements were. Each of them then prepared a presentation of their system. At the same time, the team tried to develop some outside information on the suppliers' track records, getting comments on reliability of the products, amount of downtime and quality of the support offered.

The winning supplier offered the best price, the least downtime and the fastest printing time; it also impressed the company with its dependability. Company K saw that it was going to need a lot of help and support in getting this new system up and running, so the team was particularly concerned that it could continue to rely on the supplier.

Implementation

The implementation period involved three distinct operations. The first was the installation of the new micro-graphic and printing equipment and training the staff in its operation. This was a straightforward, technology training exercise. There was one to two hours of training for each of the system operators provided by the system vendor; this was sufficient to get the staff running the equipment.

The second operation was the development of the computer database covering all the drawings that existed, the mechanism for updating this daily and the provision of this information throughout the company. The design of the database was done in-house. It had to be secure, so, although the database could be accessed throughout the company, changes could be made only in the data control department. Data entry was a large task; a team of key punchers was hired to input the data for more than 250 000 historic entries over 10 months. At the same time, the team in the data control department started to enter data on the status of all new drawings.

The third operation was the reorganization of the print cribs in the company. The implementation team started by going through the drawings in each crib and establishing who needed what. Once the number of drawings in each crib was reduced to those that were really needed, the team started to develop a distribution list for each new project. Users were to be notified when drawings for their project were released. Copies would then be provided on request, and could be either hard-copy versions or microfilm. Some reference copies were retained in the cribs. This changed the way engineers and designers could access drawings, but once the new system was explained, it was seen to be preferable to the unreliable old system.

This was the first such installation for the vendor, so much care was taken to ensure that it would go well. This constant support by the vendor was appreciated by the staff of Company K, who believe that the installation has been a great success. The documents are available quickly and efficiently, the cost of printing documents is

much lower, the database provides the information needed in a timely and up-to-date manner and the whole operation is very reliable.

It took the company about 18 months to complete the implementation, the longest part being the establishment of the database. This was a little longer than anticipated, but none of the staff believe this to have taken too much time.

Users

There are two user groups that were affected to differing degrees by this installation. The data control department staff had their daily routine completely changed as a result of the deployment of this system. The head of this department was part of the selection and implementation team and had regular input into the definition of the micro-graphic system and the database. This person was responsible for the introduction of the system to her staff. There was no difficulty in this process because the staff were assured that no one would be let go as a result of this implementation. This has indeed been the case: the department had 18 people at the start of the implementation, and now has 14 (the four who left the department either retired or transferred on their own initiative).

The data control department staff are very proud of this operation. As the first of its kind, it has been the subject of considerable attention and study, giving the staff a sense of the importance of their work. This has added considerably to the morale in the department. In addition, because the system is so much faster than the old one, the department is no longer continually fighting a backlog of requests and feeling defensive about its activities. The level of service is much improved, and the satisfaction of the staff has risen correspondingly.

The other user group involved in this implementation is the operations division. The production engineers and designers in this division have frequent need to access drawings through the department. They are very pleased with the improved service on these documents, both in getting information on the documents and ordering

copies of the drawings themselves. The cost per copy has been estimated at about one-third of the previous rate, and the speed of order fulfillment is more than twice as fast.

Conclusions

Company K attributes its success to the planning process that went into this implementation. The involvement of the user groups and the leadership of a senior manager gave this project the authority and capability required to plan a system that would meet the needs of the company. The systematic approach demanded clearly set objectives and a well-defined implementation plan that made expectations and results realistic.

The use of the MIS department as a resource, rather than as a leader in the deployment, is unusual. The approach might have been less successful if the MIS department had tried to assert itself in this project; clearly, the department realized that the project was initiated and owned by the users, and the most successful results would be obtained by supporting the initiative rather than fighting it.

The support offered by the vendor was also key in the success of this deployment. Not only did the vendor provide much needed support throughout the implementation, but its continued interest in the success of the system has had a positive effect on the morale of the data control department.

Case:	Company L
Industry:	Mining
Size:	Approx. 5 million tonnes milled annually
Location:	Northern Ontario
System:	Computerized model of mine site

The Company

This is a long-established mining company in Northern Ontario. It is owned by a large Canadian corporation but operates fairly independently. Only the largest investment decisions have to be referred to the parent company.

In 1971 the individuals providing computer support to the engineering staff at the mine site were gathered together to form an Information Systems (IS) department to give support to all staff at the mine. At that time, the company operated several systems for the geologists and engineers, assisting them to keep track of the ore still in the ground and to manage the drilling operations.

The surveying, planning, grade control and geological operations all used data stored in the mini-computer. The company runs a diamond drilling operation throughout the mine site, gathering core samples that give information on the ore content. This data is stored in the computer, allowing the geologists to make decisions about where to mine and what the expected output will be.

The mining industry suffered during the recession of 1981, and the company changed ownership. As a result, new senior management appeared, with new planning and information requirements. A director of information systems was created, and a new person was brought in to fill this role; it was the first time IS had been given such a senior position in the organization.

The System

The company has developed a three-dimensional model of the mine site, showing the geological formations and the concentration of ore throughout the site. The data are collected from the diamond drilling operation, and analyzed by the geology department, which provides input on stress lines and other geological formations. The model is available to assist in planning mining operations, showing a current picture of the ore yet to be mined and its location. This model is part of a system of five modules, each of which is built on the same database.

The Purchase Decision

The existing computer system in 1981 was being taxed by the demands being made on it by the users. The turnaround time to get information was becoming longer and longer, and some requests could not be filled. The quality of the information was suffering, and users were not confident in the accuracy of the information they received. Users were asking for changes to the system, and the IS staff had a long list of improvements waiting to be made. These requests were all reasonable and logical, but the department did not have the resources to meet these needs. The IS department was spending as much as 45 percent of its time on maintenance for the system and had little time to program new developments. It came to the point where the IS staff and the users agreed that some fundamental changes needed to be made.

The chief of scientific and technical computing in the IS department started discussions with users in 1982 to see what their future requirements were and to plan the resources of the department. He realized that the department needed either more staff or more hardware. He began to build the case for a new system.

The chief first made a presentation to the new IS director, making the case for the purchase of a new system. The director responded positively, and the process was set in motion for a major purchase decision. A committee was formed, representing

the two main user groups and the IS staff, to decide what was needed. Their objectives were to:

- improve the quality of the information available (more accurate, more detailed, received faster) so that the planners could discriminate between ore and waste;
- stop system failures; and
- reduce time spent on maintenance.

The committee was also eager to reduce costs — but not by reducing personnel. The committee felt that with a better system, it could help the company grow without increasing staff, providing a faster and more efficient operation at the firm's current level of personnel.

The chief, with the support of this committee, prepared a proposal for a $1.6-million investment in new hardware and software. He made a presentation to the mining director, who approved the project. The next step was a presentation to the operations management, who required detailed information on the project before approving it. Once this hurdle was passed, the final presentation was made to the president and chief executive at the office of the parent company. This final presentation was the most difficult, requiring lengthy discussions and a large amount of support data. A detailed cost-benefit analysis, with projections for the next 10 years, was prepared for this presentation. This document was the focus of the decision at this level.

The support of the new IS director was crucial at this point. Another director of the parent company had strong ties with the mine and was also able to support this application at this final point. Both these individuals are credited with helping to get the final approval.

A feature that appealed to the emotions of the decision makers was the fact that the mine was planning to reassert its position as a leader in information technology in this industry. The company had been one of the first mines to use computers for support, but had lost that edge in recent years as other mines made investments. Company L had done little to upgrade its system. This investment would put the company back at the leading edge of mine technology.

The Selection Process

Another member of the IS staff was given the task of preparing a detailed list of specifications for the new system. This document itemized the system currently in use and the demands for future use.

The chief visited experts in mining technology at other mines and at universities to find out what was possible, what already existed and the names of suppliers. He then visited the suppliers themselves, looking for the software that would do the job. He found that hardware suppliers were the best contacts for finding software. The hardware companies knew what had been done and were able to provide names of software companies.

The chief was looking for a software package at first, hoping to find something that could meet the company's needs with a minimal amount of adaptation. He was also shopping for a software supplier who would provide support for the redesign work. He put together a short list of three companies who could provide something close to their specifications. A team of five people from the mine spent up to a day with each of the three companies; they had a checklist of items that were required. They then tried to arrange a site visit with users of the prospective system; however, problems with scheduling and a strike at one of the sites prevented the team from seeing more than one installation.

The final evaluation and selection was based on three criteria:

- software fit;
- ability of the supplier to support customization; and
- ability of the supplier to develop new applications for mines.

The team had developed its own estimate of the cost of this system; all three bids had roughly the same price, so this was not considered a major issue in the selection. The final price was about $1.3 million, split equally between hardware and software. No cost was placed on the time to be spent by the IS staff on the implementation. The staff of seven programmers was not to be increased for this work.

The supplier selected was a large hardware company that had an in-house group dedicated to the mining industry. This was seen to be a major asset in the selection. The purchased software was in four modules from different sources. Some of it was still being developed by the supplier, but enough was already complete for Company L to see that it was the best fit for their needs.

Implementation

A detailed implementation plan was prepared by the same person who had been responsible for the specifications of the system. This person became the project manager. This plan had a critical path, with several points where the company and the supplier would agree on what had been done and adjust the specifications accordingly. A task force was created, involving members of the two user groups, the IS staff, the hardware supplier and the software suppliers. This group was scheduled to meet every two weeks and minutes of this meeting were sent to the steering committee.

There were two 'go/no-go' points with the hardware before the system was delivered, and on which the company could still refuse delivery. Once the system had passed these two checkpoints and the hardware was delivered, the company was fully committed to the installation. The payments to the hardware supplier, as head contractor, were made on the satisfactory completion of each phase of the work. The completed work was judged by the IS staff to be satisfactory after they had successfully run a series of tests. This was not merely a formality; there were occasions when it took considerable time to get approval to sign off a phase of work.

The software development did not go entirely on schedule. The customization of the packages and the development of the new module both required more time. Company L was able to bring pressure to bear on the supplier to put more of its staff on the project to try and speed up the process. The supplier ended up spending much more time than it had planned to complete the project; indeed, a member of the supplier's staff continues to work on the project still. Company L understood the reasons behind these delays — all unforeseen — and appreciated the continued support of the supplier. The total implementation time for the project was about two years. It had been forecast to take one year.

During the implementation period, the hardware supplier decided to close down its group dedicated to the mining industry, and let go some of the staff. Company L prevailed on the supplier to keep staff connected with this installation, so that the project could continue without having to introduce new staff. It succeeded in this but believed that this project was no longer valuable to the supplier.

The total budget for the project was $1.6 million. This was the amount paid to the supplier. It does not take into account the cost to the company of the time spent on the process by company staff. No new staff were taken on for this work, so existing staff had to work on the project while continuing to perform their full-time jobs. In fact much of the work was shared, so the staff did not get overburdened very often.

The company has not done an audit or evaluation of the system following the implementation period. It believes that the system is increasing revenues by improving the quality of the mine's output, the result of better information available. It has not been able to quantify the benefit but is convinced that the deployment has been worthwhile.

One benefit that has been measured is the amount of time the IS staff spend on maintenance. Prior to this system's being installed, the staff spent as much as 45 percent of their time maintaining the system; today, that is down to 30 percent and still decreasing. The amount of productive time available has risen accordingly.

Users

The two user groups at the mine were involved in this project from its inception. As a result, they feel that this system was created to meet their needs and that they are its owners. They accept the problems that were experienced during the implementation and are generally pleased with the result.

Some, however, feel that the old system, when it worked, actually produced better information. The present system is more ambitious and has a greater scope but does not do all the basic functions the old system did. One user questioned whether the new system was really worth all the expense and the aggravation. It was not clear to this user what the increased value was to the company of this installation. In spite of these doubts, this user was pleased with the data he was getting and realized that he could not do his job without it.

In the middle of the implementation, there was a substantial staff cut at the company — entirely unrelated to this new system. The user groups cut their staff by as much as 30 percent, but no staff key to this project were lost.

The users for this system are all quite sophisticated when it comes to computers. The training for the use of this system was conducted by the supplier. Several

Company L staff — both users and programmers — went to the head office of the supplier for an extended period of training that was considered very valuable. Supplier staff have also spent many days at the mine, and they were available to teach other users and answer questions. The manuals for the system were very late in arriving, which made it difficult for many users to get on top of the system or answer questions.

Conclusions

In hindsight, some staff members feel that the expectations should have been a little more realistic. This comment was directed mainly at the supplier, which should not have promised such a tight schedule. The supplier appeared unable to deny Company L anything, creating unreal expectations on the part of some staff. Company staff all have continued respect and admiration for the supplier employees who worked so long and hard to make the system work. Many of them feel, however, that perhaps the system should have been less ambitious and easier to get running.

One comment which came up from a user was that Company L was possibly too attached to its old system and that method of doing things. It might have been easier to start with a completely new concept, rather than a reworking of an old system. The approach the company used brought a number of constraints to the planning that might have been avoided if the concept had been completely new.

A significant and unexpected benefit that the company has experienced from this work has been an improvement in the working relationship between the IS group and the users. While the relationship was never bad, the result of working so closely together over the previous two years has been an increased appreciation for the problems each has to cope with and the needs of all the staff. The staff feel they are working much better together and as a result are much more understanding in their work together.

This implementation has had some strategic importance for the company, in that it has reaffirmed the company's position as a leader in technology for the mining industry. This is thought to have a competitive advantage in attracting and keeping customers. There is no way of assessing this, but the company believes that this image has helped its sales in the past and will do so again.

Case:	Company M
Industry:	Auto parts manufacturer
Size:	Revenues of $7 million: approx. 125 employees
Location:	Quebec
System:	Financial and production control system

The Company

The company manufactures metal products for various automotive customers. Its major customer is a large Canadian vehicle manufacturer. Company M is primarily a fabricator, producing stamped products rather than complex multi-component auto parts.

Founded in 1970, Company M was purchased by the current owners in 1987. The firm had 1987 sales and assets of approximately $7 million and $5 million respectively. It has enjoyed rapid growth in recent years and has a general objective of doubling its sales in the next three years. In the past three years, the company has grown from 40 to 125 employees.

The System

The company installed a complete financial and accounting system three years ago that handles general ledger, receivables, payables and payroll. This system was implemented by the previous owners to reduce the firm's clerical staff and payroll costs.

In 1987 Company M implemented a production control system, including inventory, order entry, process monitoring and MRP. These systems operate on a mini-computer. The software for the systems was originally off-the-shelf and has subsequently been tailored to meet the company's specific requirements. The system is accessed through 12 computer terminals that are located in various areas

of the plant. For example, the accounting, sales, materials planning, inventory, process control and shop floor areas are all equipped with readily available terminals.

The Purchase Decision

The initiative to consider the production system came from the general manager shortly after his joining the company in 1986. The general manager came from an environment that had actively used computer systems, and he was therefore sensitive to the potential efficiencies of an improved production system at his new company.

The general manager sold the idea of a computerized inventory and production control system to senior management based on a number of considerations. For example, there were significant improvements and cost reductions anticipated in the production control area and these were conveyed to the management team. The production system would also easily accommodate increased sales without requiring additional clerical staff. The system's prompt and accurate management information would improve the decision making and productivity of the firm; prior to the implementation of the system, management information was derived from estimates made by the plant foremen. The new owner had significant previous experience with automated systems, and this implementation resulted from his strategy of improving the firm's efficiency and productivity.

A formal cost-benefit and technology plan was not undertaken for this investment. The benefits of the implemented production system included improved production decisions based on more accurate and timely reports, improved discipline in the production area, the ability to handle additional business without increasing staff and the ability to plan production more effectively.

Because it was anticipated that certain users would be reluctant to adopt the new system, users were not consulted during the decision process. There was also no formal analysis of user needs.

The cost of the first and second components totalled $60 000, of which $40 000 was directed toward actual hardware and software and $20 000 toward implementation and training expenses.

The Selection Process

The selection process for the production system was quite informal and unscientific. The company identified an opportunity to purchase a complete inventory and production-control system, including hardware, software and costing information for an excellent price from a recently bankrupt competitor. The opportunity was even more attractive given that Company M had secured the business of approximately one-half of the bankrupt competitor's clients. Having secured these clients, it was important that M also obtain the costing information that came with the system. This decision was therefore mainly business-based. The attractive price of the system increased M's willingness to accept certain limitations associated with the hardware capacity and the software structure of the purchased system.

Implementation

The implementation team included a full-time systems analyst retained specifically for this project. The controller and the production assistant were also members of the implementation team. The production assistant was quite familiar with computer systems, and the systems analyst had no previous experience with the specific system or with the company. The team reported directly to the general manager.

The implementation was carried out in a phased approach. This type of approach was taken for a number of reasons. For example, it increased the 'comfort level' of

the owners with the new system components as they were implemented. It allowed sufficient time for training while also permitting regular monitoring of users' acceptance of the system.

The implementation produced some benefits, the scope of which were not anticipated at the time of implementation. For example, the firm's supervisory personnel 'bought into' the system to a far greater degree than anticipated. The foremen have come to understand the value of the automated system and now recognize it as being far more efficient than their traditional 'rules of thumb' method of providing information to management. The productivity and production benefits that have been realized were also greater than anticipated.

The company faced a few complexities with implementation. These were primarily the result of the 'Just-in-Time' (JIT) requirements placed upon M by a major client. Because the JIT approach allowed clients to place orders weekly, the company faced the risk of implementing the system just as a major order was placed. This would disrupt the normal production management process and possibly cost the firm lost business. To accommodate this risk, M monitored this client's needs and expected orders very closely during the system start-up phase. The system was implemented without problems of supplying clients.

A second phase of this implementation was planned from the start but has been delayed as a result of the change in ownership of the company. The general manager is now planning to upgrade the production system to include the added features of time and human resource management, process and efficiency planning, and production scheduling. In light of the successful implementation, the approach to this second phase will be slightly different from the original. The company is undertaking some cost-benefit analysis on this component to analyze the expected return from this investment.

The company has decided to employ consultants to assist it in the planning of the system, the selection of the software and the installation. It is also consulting the users during the planning stage to identify user needs and constraints. The

management feel that the users are now sufficiently comfortable with the technology not to feel threatened by a new system, and will take to its use quite quickly.

The new system was selected to be fully compatible with the existing system. Company M believes it will have spent about $150 000 on this installation over two years.

Users

User resistance to full acceptance of the new system caused the firm to direct significant effort toward the training of users. Those at the supervisor level were trained first.

Implementation of the systems was conducted department by department during a period of about 10 weeks. The training included structured information sessions, as well as informal interaction with users and the gathering of input from senior users regarding the preferred format and output of the system. These information sessions were felt to be among the project's most important success factors. The training was provided by the implementation team without the assistance of suppliers or consultants. The team felt that it could best understand the needs and concerns of the users.

The general manager attributes most of the credit for a successful development and implementation to the team's effort in interacting with the production people. The decision to allocate a full-time analyst to the development of the software and the firm's commitment to the training area were also important success factors.

Conclusions

The increased efficiencies resulting from the new system have not been quantified, though the firm's management and staff believe them to have been achieved. The

firm's management did not anticipate the degree of benefits that have resulted from the automation. For example, the doubling of the firm's volume during the past three years with no required increase in clerical staff was not anticipated. In addition, M's reports are more accurate and up-to-date, and this has improved the firm's scheduling and production planning.

From the way the company is planning its next installation, it is clear there are some lesson learned from this installation:

- involvement of users is necessary, but the timing may vary according to the ability of the users to absorb knowledge of the technology;
- a phased and flexible approach allows the company time to embrace the system in a manageable way; and
- training and discussion of the new system are crucial parts of a successful implementation.

Case:	Company N
Industry:	Forest products
Size:	Revenue of $150 million; employment of 1000
Location:	Ontario
Implementation:	Human resources management system

The Company

Company N currently employs approximately 1000 people in the manufacturing of wood products from pulp and logs. The company's annual sales are approaching $150 million. The company has an annual data-processing budget of some $1.4 million. The cost of the system implementation profiled in this study was around $300 000.

The System

In 1981, the vice-president of human relations acquired a portable micro-computer for use in his office. A few years later, having become familiar with the capability of basic spread-sheet packages, the vice-president began to believe that significant benefits could be realized through the use of a computer to manage the firm's personnel-related information. The firm's 1000 employees are organized into 18 bargaining units with 16 negotiated contracts and two non-negotiated contracts, and this executive felt that computerization of the large quantities of associated information would be beneficial to the company.

The resulting human resource system operates on a mini-computer and includes components dealing with records management, payroll and benefits control. A pension plan administration module will be added within the next three months, while a salary administration module will also be developed in the near future.

The system is currently centralized within the human relations division of the company, though it is anticipated that the system operation and maintenance functions will be incorporated in all of the company's divisions within six months. When fully implemented, the system will manage information on all of the company's 1000 employees.

The Purchase Decision

The decision to develop a computerized system was based upon a number of considerations. Prior to the development of the new system, management of human resource information was contracted out at a considerable management-fee cost to the firm. The company believed that in-house management of the information would be less expensive. Furthermore, the company had limited access and control over this information. For example, if an employee requested information regarding payroll, deductions, benefits or pensions, the company had to pass the request along to the contractor who in turn took approximately one week to provide an answer. By improving access to and control over its human resource information, the company hoped to become more responsive to employee requests.

A third consideration centred on the fact that the contractor was somewhat reluctant to provide the newer benefits and pension options that had recently become available in the database industry. Company N anticipated that an in-house system would include these new benefits and pension products.

A final consideration was that an in-house computerized system would provide the firm with an opportunity to increase the accuracy and consistency of its human resource information. Because different types of human resource information were held by different groups within the organization, the controlling of accuracy and consistency was extremely difficult. For example, the contractor maintained the firm's financial information while the company divisions were managing operational data and the human resource group was managing tombstone employee data. The distributed system of information management created a situation of minimal

communication between the various groups. As a result, the groups were not contributing to the accurate maintaining of status changes and other types of important human resource related information. The company hoped that a new system would bring the various information elements together to improve its manageability and accuracy. It is anticipated that the decentralization of system management to the individual divisions will accomplish this goal in the very near future by requiring individual divisions to be fully responsible for maintaining their own human resource information on the new system.

Based on a concern for the firm's best interests, the contractor that was administering the company's data actively encouraged the company to develop an in-house system. While this contractor was consulted throughout the selection and implementation process, the firm was somewhat disappointed in the contractor's inability to identify specific strengths and weaknesses of different systems.

The vice-president of human relations, who in effect 'championed' the implementation, felt that the main benefits were the improved human relations information and service that would stem from the new system. Of high importance was the capability of offering more current benefits and pensions packages and the ability to be more responsive to employee requests. The maintaining of smooth human relations is very important to the firm because of the direct impact that labour disruptions have upon company profits. Improved relations would serve to minimize the risk of their occurrence. As part of the firm's strategic plan to improve its human relations, the company has directed close to $1 million toward improving corporate operations.

The champion's initial step, upon realizing the potential benefits of an automated system, was to seek the collaboration and cooperation of individuals within the firm's systems division. He also had meetings with other individuals who were felt to have skills to bring to the development and implementation processes, should the firm decide to purchase a system. The champion accompanied the systems manager to a conference that featured computer systems of relevance to the human resource functions. As a result of the information obtained through this conference, both

individuals became quite convinced of the benefits of proceeding with the development of an automated system.

A formal quantitative cost-benefit study was not undertaken in conjunction with the purchase decision. However, the systems manager was quite familiar with the approximate scale of the expected benefits and costs and conveyed these to the champion. In addition to this information, the champion intuitively believed that the new system was essential to the company. Based on this general feel for the costs and benefits, he therefore recommended approval of the project.

Prior to the implementation decision, the firm did not have a formal technology plan. Such a plan is currently being compiled by the firm as part of the overall strategic plan.

The final decision to proceed was provided after about a year. This delay stemmed from the other priorities facing the human relations area of the company. The assembling of a qualified implementation team was also delayed by the fact that proposed members were already involved in other projects and thus not instantly available for this team.

The Selection Process

The implementation team was headed by the systems manager. The team included a systems analyst who had experience with the recent implementation of a general ledger system, as well as a likely user who was highly familiar with the cost-accounting and payroll areas and another likely user who was familiar with benefits administration. The project champion, as vice-president of human relations, also provided input regarding future directions and trends within the human resource management field — areas that would obviously have to be addressed through the design of the system.

As an initial step, the team developed a requirements manual based on its knowledge of the needs of the company and the potential users of the system. The team then surveyed North American software suppliers to identify those who could meet the needs outlined in the requirements manual. Five potential suppliers were identified through this process. Subsequent input from the firm's human resource contractor (who acted as subject-matter specialist throughout the process) reduced the number of potential suppliers to a short list of three. The team avoided mainframe-based systems because of both the excessive overhead required to support such systems and the familiarity that the systems manager already had with mini-computer technology.

The short list of three firms was reduced based on the ability of each firm's system to meet requirements as specified by the team and based on the perceived willingness of the supplier to define and build the system to meet the firm's exact needs. System cost was not a major factor in the decision. The formal requirements were outlined in a document that was provided to the three potential suppliers who were, in turn, requested to identify those requirements that could be met by their system. In retrospect, team members felt that this approach had limited use, as the suppliers responded categorically that they could meet all of the specified needs.

The eventual winning selection managed to display a greater recognition of the company's needs, while also appearing to be more forthright regarding the features that could and could not be supplied by his system. The supplier already had a payroll package that was directly applicable to the firm. The benefits package was designed in a mutual manner, wherein the firm and the supplier became partners in developing an acceptable system. In so doing, the vendor acquired an additional system and a pilot site, while the firm gained a custom-designed system.

During the selection process, the team contacted several users of systems supplied by the shortlisted firms, and this was felt to have provided valuable input to, and increased the firm's conviction in, its eventual decision.

The process of comparing software was completed within a week. While the firm is satisfied that the selection criteria for the system was appropriate, in retrospect it would have solicited increased support either from its human resource contractor or from an additional outside source. The contractor provided only general knowledge of benefits and related systems rather than the more specific recommendations that the firm would have preferred. The firm felt that the contractor, as a human-resource system expert, should have been able to direct the selection team toward the most appropriate software supplier.

In retrospect, the systems manager feels that the firm should have been more demanding of the supplier in certain areas. For example, the screens should have been designed in a bilingual manner to better meet user needs.

The manager also indicated that the hardware limitations of the software affected the selection decision. The software could only operate on one brand of mini-computer hardware, a brand with which the manager was very familiar and comfortable. He believes that this comfort factor probably influenced his decision.

Implementation

Shortly after having been selected, the software designer commenced design work with the implementation team. While a formal implementation plan was developed, it turned out to have underestimated the amount of effort required in the implementation of the project. The plan became largely irrelevant and "altered at every meeting." For example, the firm encountered difficulty in locating all available data and in confirming the data's accuracy with each employee. The existing data were felt to be very unreliable thus necessitating the need to review its accuracy with employees. This task was time-consuming and the degree to which it delayed the implementation process was largely unanticipated.

The new system has, to date, been implemented only in the company's human relations division. The high degree of overlap between the implementation team and

this division led to a relatively smooth implementation process. However, the training and installation services provided by the software supplier were lacking in certain areas. Though used by the firm, these services were also heavily supplemented by additional training services designed by the implementation team.

The systems manager feels that the team has designed a system with the foresight and flexibility to accommodate every benefit and pension option encountered to date. While the system has not been deployed for sufficient time to accurately gauge the benefits, it is felt that certain benefits have already been realized. For example, the human resource data is more accurate than was the case under the previous system, and the new system is far more responsive to requests for information. The decentralization of the system will bring further improvements that will ensure the accuracy of data and a faster response time.

The overall cost of the project was approximately $300 000, of which some 20 percent was software-related and 80 percent hardware-related. It was originally planned that only one person-year would be required for the project. However, the project eventually required five person-years.

Users

During the implementation process, the firm faced the challenge of countering the perception of certain users regarding the system's capabilities. Initially, the users believed that the new system would automate every aspect of information management, including the updating of all employee data and options. However, because of the complexity of benefits and pension packages and the large number of options available to employees, the level of automation was more limited than originally expected. The systems manager feels that this was not an unusual perception; many new computer users overestimate the scope of computers believing that they can automate everything.

The firm also encountered difficulties with psychological resistance among certain users. Some user groups reacted more negatively to the system than anticipated, and the firm attempted, with some success, to address this through the use of information sessions and documented information. To ensure that the ongoing decentralization of the system occurs smoothly, additional efforts will be made to ensure that users are fully prepared and that they recognize the potential benefits of the system.

Aside from those on the implementation team, users were not formally consulted during the decision phase. During the selection and implementation phases, potential users were interviewed to obtain the data required for the system. Partly as a result of a general belief that user interaction was insufficient in the initial implementation, the team is taking certain measures to support the upcoming spreading of the system to the other divisions of the firm. For example, to ensure successful decentralization of the system, a formal training program is being developed and pilot sites are being designated to assist in familiarization and acceptance. Specific 'event-oriented' procedures are being developed to support users once the system has been decentralized.

Conclusions

In retrospect, the systems manager would have devoted greater effort to determining the complexity of the system, to estimating the time and resources required for its design and implementation, and to anticipating user reactions to the system.

There were a number of unanticipated variables that caused delays during this project. The gathering of employee information became a drawn-out process. The former contractor did not provide the detailed advice that was hoped for. The training provided by the vendor was sub-standard in many areas, forcing the company to supplement with its own training. The requirement for the champion and implementation team to deal with day-to-day activities and priorities further increased the difficulty of adhering to the implementation plan. Finally, the adverse reaction of

certain users necessitated the 'selling of the project' to a greater degree than anticipated. The firm, in retrospect, would have devoted more time and effort to dealing with user concerns and in receiving user inputs.

Case:	Company P
Industry:	Automotive parts
Size:	Revenue of approx. $20 million
Location:	Ontario
Implementation:	Production and inventory management system

The Company

Company P is a rapidly expanding producer of metal components for use in different types of motors and transformers. Among the firm's one hundred active customers are a number of companies that make motors for appliances and other electrical applications.

The company had traditionally handled its inventory control through a Cardex system, wherein finished goods, raw material and work in progress were manually recorded on cards for each of the firm's 15 grades of steel. The system tracked the raw material as it entered the plant, progressed through the fabrication process and exited the plant as finished goods. Cardex calculations were conducted daily, generally requiring about eight hours to complete. The requirement for a new system became evident as the firm grew in size and as the existing system became increasingly inefficient.

The System

The system profiled in this case is a mini-computer based production control and inventory management system installed by the firm in late 1987. The system includes inventory management, listing and valuation systems, along with a production control report. The latter is used by the production manager during scheduling of the necessary number and timing of 'machine hits' required to meet customer requirements.

The Purchase Decision

In recent years, Company P's sales have increased rapidly: from $12 million in 1985 to $18 million in 1986 and to $20 million in 1987. Similar growth is projected through 1988. The Cardex system required a significant amount of manual calculations and entering of statistics onto the cards. The firm employed one person simply to handle the data entry and mathematical calculations involved in recording the inventory on a daily basis. Because of its manual nature, the system was "generally two days behind in any process." The system also involved a duplication of effort between this person and employees in the order/entry area, wherein both parties were required to record sales for their own use. In fact, the inventory, production and sales groups each maintained their own order books to meet their specific requirements. The lack of instant access to current information occasionally led the sales people "to sell things we didn't have." The fact that four or five individuals may be selling simultaneously also made it difficult for the inventory data entry person to incorporate this information into the Cardex system quickly enough.

Competitors of Company P had generally moved ahead in the computerization of the inventory area, a fact confirmed by a new employee of Company P who had previously worked for a competitor.

As the firm virtually doubled in size during a three-year period, the number of necessary inventory calculations increased significantly, as did the time required to conduct the calculations. Furthermore, because only one individual was aware of the exact inventory and work-in-progress status of the firm at any given time, this person in effect became a focal point for all employees requiring such information. Thus the sales, purchasing, production, inventory and other managers began to refer questions to this individual with increasing frequency. This introduced further delays and inefficiencies into the system, not only for the employees but also for customers' enquiries regarding the firm's availability of time and material to complete a prospective job.

The purchase of a computer system and a few terminals would allow the sales-order
entry personnel and the purchasing, production, inventory and financial control personnel to have immediate access to the firm's most current inventory, raw material and work-in-progress status. The purchase of a computerized system would also allow the firm to monitor its inventory status to within a half-day of actual levels. Current efforts to bar-code all merchandise will allow inventory to be tracked as it progresses through the manufacturing process.

Prior to selection, the firm had a fairly solid understanding of the expected costs of the system. However there were not similar estimates regarding the projected benefits. The benefits were largely based on intuition. For example, it was felt that the new system would allow the Cardex data-entry person to direct approximately one-half of her time toward the purchasing function, which she found more enjoyable and stimulating. A computerized system would also increase the speed and accuracy of the inventory control function and would allow many individuals instant access to the system without having to go through the data-entry person for information. A system would reduce uncertainty among the sales department regarding the number, size and type of orders that could be filled.

The rapid growth of the firm and the resulting time delays and inefficiencies of the Cardex system led the senior management of Company P and of the parent firm to decide "that it was time to do it. The firm could not continue to grow at 20 percent annually without automating the inventory control system."

There was no formal cost-benefit study accompanying the decision — "why go through a big study if we know it will help us?" A further factor in the purchase decision was the smoothness of implementation and the resulting efficiencies of the firm's automation of the accounting function in 1985. Company P's general manager had been impressed by this and, while not a system expert himself, he was confident that automation of the inventory area would result in similar efficiencies.

Having decided to purchase a system, the firm hired a full-time controller and systems manager to take charge of the implementation. This individual was to ensure that all potential users of the system were consulted and 'brought onside' with the system and its benefits.

The Selection Process

The firm had an ongoing relationship with an outside consultant who was extremely well versed in both the firm's requirements and in the design of inventory control systems. The consultant was a former employee of P's parent firm, who had subsequently become self-employed. He was involved in the design and implementation of this automated inventory management system.

The system selection phase involved the designing of software to meet the user's requirements and to fit the mini-computer that had been previously purchased to handle the accounting function. The cost of the software design totalled approximately $8000, and the five terminals cost $6000.

The design process involved building upon the Cardex methodology while, at the same time, incorporating the desires of the managers of the purchasing, production and sales groups. Thus, it was necessary for the system designer to first fully understand the workings of the Cardex system before commencing the design process.

Implementation

The responsibility for the implementation of the system was clearly defined from the outset as resting with the newly hired controller-systems manager. The fact that one individual was mandated with this task, and in effect became the firm's focal point for this matter, was felt to be a major factor in the successful system implementation. It was known throughout the various user groups that this individual was mandated by

senior management to implement the system, and he was to be responsible for handling problems and for maintaining constant contact with the system designer.

This individual was described as being very receptive to suggestions and very capable in accommodating and responding to the desires of the various individual users. Because the individual felt that rapid response time was required to convince the users of the system's value, he placed a strong emphasis upon addressing the concerns of individuals as a top priority, generally on the same day. His personal preference was for one-on-one meetings with the users as often as required. He was not reluctant to call the system consultant to discuss user concerns with the system as it was being designed. On many occasions, even after the system was operational, the designer was called to the shop to discuss desired changes or additions to the system and its output.

Another major factor contributing to the success of the implementation was the fact that the consultant was extremely well versed in both the firm's requirements and the design of inventory-control systems. The implementation of the system involved an estimated 150 hours worth of his programming time, and the total software-related costs were estimated to be approximately $8000.

Because the consultant has been engaged by Company P on an ongoing basis (he is currently assisting with P's effort to bar-code its merchandise, which will permit instant monitoring of the production process) the firm has installed a modem in the consultant's home that allows him to quickly respond to pressing system-related problems.

The consultant was described by the champion as being a weak documentor of information. The consultant's extensive knowledge of systems was believed to have reduced the consultant's belief in, and hence the quality of, the accompanying documentation.

The implementation process was not audited — the company was neither big enough nor formal enough to undertake a formal auditing — and the firm generally

has avoided bureaucracy and paperwork to as great an extent as possible. The senior management of the firm, however, did keep in fairly regular contact with the progress of the implementation. There had been a general implementation deadline established upon making the purchase decision, and the system was fully operational approximately one month after this initial target date.

The Cardex system and the new system were run in parallel for approximately two weeks. Although simultaneous usage was desired for a longer period of time, it quickly became far too burdensome for the affected people to handle, and the Cardex system was discontinued. The firm operates within a very tight production schedule, and it was very important to keep inventory measurements up to date. The simultaneous running of the systems threatened this schedule — inventory measurements were becoming difficult to maintain — and the production manager was becoming lost in his scheduling. It was suggested that perhaps the ideal situation would have allowed the data entry person to 'play around' with the new system, while a temporary hire handled the inputting and calculations associated with the manual Cardex system.

The entire implementation process, from decision-making to full-time usage, took approximately six months, of which three months constituted the true 'action period.' The implementation could have been cancelled at any time during the process, though this was not an option that was ever considered by the firm.

Users

Users played a totally interactive role throughout the selection and implementation phases. Because the system was designed to emulate the Cardex system, the administrator of the Cardex system was consulted almost every day. The administrator had obviously become highly familiar with the Cardex system and its benefits and drawbacks.

An initial drawback of the new system, from the perspective of this administrator, is the rapid speed with which the computer conducted the calculations and the resulting difficulty of her 'staying in touch' with the operations of the new system. A further drawback was that whereas all of her required information was visible on one card under the Cardex system, the computerized system necessitated flipping back and forth between a couple of screens to see all the information. However as the implementation progressed and this individual observed the system's ability to correctly 'move' quantities from inventory to work-in-progress to finished goods, she became increasingly confident in the system. She also became able to direct one-half of her day toward more enjoyable purchasing-related activities.

Although the designer and users attempted to anticipate as many of the desired features as possible, it was very difficult to "know what they wanted" before actually seeing the printout. Thus, many of the output reports were revised and tailored two or three times by the system designer to meet the wishes of the users. The layout of the screen was also designed in the presence of the users.

There were other individuals who were required to make adjustments to accommodate the new system. For example, those responsible for labelling boxes and parts were required to pay strict attention to the use of correct part numbers. Because the entire inventory control system hinged on correct numbering, it was necessary to remind the affected floor workers of this fact on many occasions. This increased the workers' attention to detail and thus represented a change in the traditional operating habits for these shop workers.

A further operational change was required in the raw material area. Whereas formerly many individuals would come and go with raw materials as they pleased, after the implementation it was necessary to charge one individual with the responsibility of taking, replacing and recording raw material. Another operational change was the requirement to back-up the new system. This is done quickly by a part time hire during the noon hour of each day.

The system is relatively easy to operate, largely because of the simple operational functions of the company. Being basically a fabricator, the company handles no sub-assembly of parts. A fairly simple system is therefore sufficient to monitor and control the movement of a product through the process. The inventory data entry person had no prior computer experience. She was very familiar with the Cardex system, and the fact that the computerized system was designed along the same methodology made it quite easy to learn.

There was one user-related benefit from the new system that the firm had not anticipated prior to implementation and that has turned out to be quite useful. The system has allowed the firm to derive quick estimates of its daily sales volume, and these are now being posted in the plant such that each of the three shifts are aware of the firm's progress. This benchmark is felt to have been positive both in motivating employees and in keeping them informed regarding the firm's level of activity.

The firm is currently considering the establishment of a U.S. warehouse, and the installed system would be capable of controlling the inventory flow of this warehouse. This flexibility is an aspect that was not fully considered prior to the purchase of the system. It, in effect, constitutes a further unanticipated benefit of the system.

Conclusions

This case profiles a typical fabricating company experiencing rapid growth and a resulting inefficiency in its manual inventory control system.

The success of the implementation in this instance was assisted by a number of factors, including:

- the active involvement of users throughout the design and implementation phases;

- the charging and identifying of one individual with the mandate to implement the system;

- the quick response-to-problems strategy of the person in charge of implementation as an aid in selling the system's worth to the various users;

- the existence of a system designer with significant knowledge of both the firm's requirements and the system's capabilities; and

- the generally cooperative and enthusiastic approach of the firm's employees.

Case:	Company Q
Industry:	Automotive parts
Size:	800 employees
Location:	Ontario
Implementation:	Robotics

The Company

Measured in terms of robots per employee, Company Q is one of the most advanced manufacturing firms in North America. Whereas five years ago the firm had no robot installations in its plant, today there are several dozen robots and additional implementations continue to be made.

The firm employs 800 people, up from some 300 in 1983, and occupies a sizeable manufacturing complex in southern Ontario. Company Q's majority ownership is held by a foreign parent company.

The firm is very active in productivity improvement, currently installing a MRP system with bar-coding. The firm also has CAD capabilities.

The company makes automotive stampings, supplied mainly to a large original equipment (OE) automotive manufacturer. The precision and quality of these stampings, as welded by the robots, is felt to meet world-leading standards and has led the OE manufacturer to rapidly expand its purchases from the firm. This, in turn, has led to the requirement for more robots and employees.

The System

Company Q initially installed six robots in 1983 to improve the welding and overall quality of its metal stampings. The increased business stemming from these implementations caused the firm to install an additional 6 robots and, subsequently,

another 4 and 10 robots. More recent installations have continued, bringing the firm's total to several dozen. This case profiles the implementation of the original six robots.

The robots are used primarily for resistance welding of metal stampings such as radiator yokes, control arms, hinge pillars and other auto body and suspension parts. Most of the robots in the plant, including all of the original six, were supplied by a major offshore manufacturer.

The Purchase Decision

Prior to the initial purchase, all welding in the plant was done manually. While quality was not a major problem for the firm, it was conscious of the trends in the auto parts industry. The OE manufacturers were increasingly willing to contract out parts production. Company Q recognized the importance of robotization as a method of improving product quality and therefore of gaining an increased portion of the OE market.

During this period, the firm was visited by a representative of a large offshore manufacturer of robots. The initial call was followed by a more formal proposal regarding the benefits which robotization could bring to the firm. In response to this call, Q began to consider the purchase of robots in a more serious vein. Subsequent cost-benefit analysis and other information led the firm to make a decision in favour of purchasing six robots as an initial investment.

The robots, in effect, represented simply an upgrade of the existing system — a method of passing the more menial tasks along to machines while the labour force assumed roles of controlling, adjusting and feeding the machines.

The director of engineering conducted the cost-benefit analysis and other research into the rationale for a purchase of robots. He was also charged with the responsibility for selecting and implementing the system. As the individual who was

initially approached and brought onside by the vendor, and as the individual who recommended the initial purchase, he in effect became the 'champion' of the implementation.

The engineering director reported directly to the president of the firm and his recommendation regarding the initial robot purchase was approved by the president. The recommendation was based on financial analysis as well as on some input from the various affected areas of the firm. However, the analysis and the industry trends were such that the purchase decision would have been affirmative even if resistance had been encountered from certain other areas of the firm.

The Selection Process

The company purchased the robots from the firm who had initially approached it. This reflected the fact that this vendor was a world leader in robot manufacturing, and already had various installations throughout the automotive industry. Upon receiving the vendor's proposal, the champion evaluated "two or three" other systems and talked with certain users of the vendor's product. A meeting with personnel at an OE manufacturer's robot centre in Detroit produced very positive sentiments regarding the vendor's product. This was a major reassurance for Q in its selection decision.

During the one-month decision-making period, Q was in regular communication with the vendor. This period allowed the firm to become more confident in the vendor's capabilities. This was an important process because the eventual system-selection decision entailed a turnkey installation, that is, the vendor was charged with handling virtually all hardware, software, installation and training aspects of the project.

Implementation

The costs of the initial implementation project totalled approximately $1 million. The firm had a formal auditing procedure established for previous capital expenditures, and this was applied to this implementation. The implementation phase took approximately five months, during which time the vendor installed the robots and trained the users to the point where they were comfortable with the new system.

The firm has a productivity improvement program that has been running for approximately seven years. The program is aimed toward cost savings through improved productivity, and it recognizes those individuals who have made valuable contributions to the firm in this regard. The program demonstrates the firm's commitment toward improved productivity, and its existence is an example of why the robot implementations were relatively trouble-free.

While the firm had only limited experience in implementation of information technology, it did have significant experience in projects involving sophisticated machinery. The engineering department, under the lead of the vendor, handled the implementation process with few difficulties. Outside sources of expertise, such as the Provincial Robotics Centre and outside systems consultants, were not used. The engineering director's opinion, in this regard, was that they would have added to costs while bringing minimal benefits.

Being one of the earlier robotics installations in Canada, the firm devoted considerable effort toward countering the psychological resistance of the system users. The firm held a Saturday open-house attended by many employees, during which a robot was displayed and operated by the vendor. Electricians and technicians were trained in Toronto and in the United States on the maintenance, overhaul and programming of both the robots and the peripherals that tie into the robots. The operators of the robots were trained in the loading of parts and in the operation of the equipment. The tool makers were trained in adjusting fixtures, checking tolerances and testing various parts.

The firm had an established implementation plan, and the supplier was contacted frequently to insure its adherence to the plan's timetable. The project was completed in five months.

In retrospect, the champion felt that system selection and implementation could have been improved in certain small ways. The rapid evolution of technology threatens obsolescence of all technological purchases, and the champion's response to this is that he could only purchase the most suitable system available at the time of decision. Repeated delays in the selection process would simply have cost the firm significant productivity improvements. "For what was available at the time, we made the right choice."

During the implementation phase, the vendor and Q had a minor contractual dispute that was resolved through the brief intervention of the firm's lawyers. In general, relations between the vendor and Q have remained strong, to the extent where Q recently purchased 18 more robots from this supplier.

Prior to implementation, the company realized that the quality of output from the robots was only as good as the quality of input to the robots. Because robots cannot discern good quality inputs from poor quality, they would weld whatever was placed under them. In anticipation of this, the firm was forced to pay much greater attention to the quality of steel and the quality of parts that were welded by the robots. This in turn forced quality improvements upon the press room.

There was one significant benefit associated with the initial robotic installations that was not fully anticipated by the company prior to the implementation; namely, the unanticipated degree of extra business resulting from the robot-induced product quality improvements. The OE manufacturer, upon receiving the robot-welded parts, began to insist that all of the purchased parts from Q be robot-welded. This effectively forced Q to purchase more robots which in turn resulted in more OE business. As described by the champion, "We knew the project would bring good results, but we had no idea that it would open the doors that it did. Today, we are

the sole supplier for four OE plants and we could not have anticipated this at the time of our initial purchase."

Users

As one of the earliest robot installations in Canada, the project represents an interesting study in user response to computerized systems. At the time of the initial installation in 1983, the firm had around 300 employees. In 1988 the firm has several dozen robots and employs 800. Clearly, the robot implementations have improved product quality to the extent that OE purchases have greatly increased. The requirement for robots and manpower has also increased as the trend 'snowballed'.

Employment in the area affected by the first implementation totalled 14 people, largely in a welding capacity. Since the implementation, 11 of these workers have been displaced to other areas of the plant, and only 3 remain. These employees operate in a loading and control capacity. The firm's efforts in accommodating the employee's apprehensions were directed mainly toward illustrating the employment and job quality gains that would stem from the project's increased business, rather than the job displacement that would occur in certain areas. The union and employees responded quite well to the firm's efforts. Subsequent implementations have been received even better than the first.

Conclusions

Company Q operates in a highly competitive business where precise tolerances and quality standards often mean the difference between contracts being won and lost. The firm has an active productivity improvement program that is clearly supported by its management. The director of engineering reports directly to the president and, furthermore, clearly has the respect and 'ear' of the president. The firm actively

deploys new technology. Occasionally, as was the case in this instance, these technological 'jumps' have contributed to large increases in business.

The firm, in this instance, had a fairly good understanding of the costs associated with the planned implementation. The anticipated benefits were projected in some detail by the firm, though these turned out to be much smaller than the realized benefits.

The vendor of the system is one of the leading robotic firms in the world. Company Q has had an ongoing relationship with the vendor since the initial purchase. In reviewing the initial proposal, Q contacted several users of the vendor's product and received unanimously positive remarks — a fact which increased Q's confidence in its decision.

Case:	Non-Deployment Case S
Industry:	Retailer and wholesaler of education products
Size:	Two retail stores with 14 employees; one wholesale outlet
Location:	Ontario
Implementation Considered:	Various retail and wholesale systems

The Company

The company profiled in this non-deployment example consists of two retail outlets and one wholesale outlet in Ontario. Combined with affiliated stores in the Maritimes, the firm has a total of 10 outlets in Canada. The Ontario warehouse supplies educational products directly to various schools, hospitals, prisons and other institutions as well as supplying the two Ontario retail stores.

The Systems Evaluated

The owner of Company S spent approximately 2.5 years examining several dozen systems prior to eventually making a purchase decision. The systems were generally either computer-based point-of-sale systems with strong retail applications, or computer-based order entry systems with strong warehousing applications. There appeared to be a shortage of systems that could address both the point-of-sale recording requirements of Company S's retail shops and the inventory and product-movement recording requirements of the warehouse. A number of these systems were examined by the owner during visits to the United States, and on certain occasions he was very close to making a purchase decision.

The Reasons for Not Proceeding

Because the firm has both retail and warehouse operations, the selected system had to accommodate these two, quite different types of operations. In addition, the selected system would require a strong capability for handling multiple pricing and other irregularities because of the wide variety of customers using the firm's products.

The primary reason causing Company S to make a non-deployment decision on many occasions was system-related. Essentially, the correct system was not found. Each system reviewed had warehousing strengths accompanied by retailing weaknesses or vice-versa. The availability of systems that could adequately provide the retail and wholesale, mail catalogue and order entry aspects that it demanded was very limited.

The owner of Company S says that the price of the system was a very secondary consideration. In fact, none of the systems that he reviewed ever reached the price negotiation stage. The cash system which was eventually purchased after some 30 months of evaluation was felt to be more expensive then a PC-based system he had examined.

Certain point-of-sale systems were considered by the owner but felt inappropriate for different reasons. For example, the stores operate in shopping malls open 12 hours daily, and the owner would have had to process the purchasing-related information "at midnight every night" to derive the maximal (purchasing) benefit from the system. The owner's concern with computer crashes, power failures and disk problems also contributed to his eventual purchase of an intelligent cash system rather than a computer-based system.

The point-of-sale computer-based systems reviewed by the owner generally included strong inventory control and purchasing aspects. To be used effectively, these systems required a significant amount of product-coding effort. The owner did not

anticipate using the ordering-purchasing aspects with sufficient frequency to justify the large amount of product recoding effort that would be required.

In reviewing the many systems, the company's owner was presented on many occasions with vendor promises that the system could be "designed to fulfil such and such a task." The owner remained skeptical of such promises throughout his search, feeling that system capabilities should be actually demonstrated and proven in real situations rather than simply being theoretically capable of performing the required task.

In the few instances where the owner was seriously considering a particular system purchase, he spoke with industrial users of the system in question and found this to be an informative and truthful source of information.

The owner holds the opinion that most businesses are moderately uncertain regarding their future directions, and system purchases must retain flexibility to as great a degree as possible. Certain systems were rejected by the owner because of a lack of flexibility. As discussed below, the purchased system was of a modular variety wherein purchasing modules, labeling modules and others could be purchased by the owner if desired at some point in the future.

Subsequent Activities

The owner of Company S has recently proceeded with the purchase of a system that is felt to closely match his requirements. The purchased system is a dedicated point-of-sale system, selected for reasons of back-up safety and ease of use. The system has optional modules, of which the owner has purchased the accounting, order entry, multi-company, separate labeling and report-writer modules.

Conclusions

While the owner has stated that price was no consideration, clearly he had an implicit price ceiling in his purchase process. Systems are available to do what he required, but they are scaled for larger establishments and cost more than $30 000, a price this manager was not willing to pay. No strict cost-benefit analysis was done to see what value such a system could bring to the company.

The owner was looking for an assurance that the system he was buying was already tried and tested. He had heard enough "horror stories" about what can go wrong with new systems that he was being very careful to avoid that pitfall. It was important that the vendor be able to convince this manager that these problems would not occur with the system he was about to buy.

The two main barriers to deployment in this case were:

- lack of cost-benefit analysis to set a price ceiling; and
- need for confidence in vendor.

Case:	Non-Deployment Case T
Industry:	Retailer of sporting goods
Size:	Estimated revenue of $1 million
Location:	Ontario
Implementation Considered:	A retail store inventory management system

The Company

Company T is a major, diversified sporting goods retailer in this eastern Ontario city. The firm has estimated annual revenue of $1 million and is a member of a 160-store Canada-wide buying group. The buying group assists sporting goods retailers with different purchasing and operational functions.

Company T deals with several hundred suppliers and the transactions are often quite complicated, involving service charges and other costs. The company also has sales to institutions as well as to conventional customers. The profit margins vary greatly among the customers. The firm has an extensive amount of paperwork to maintain and organize, "far more than most sports stores."

The Systems Evaluated

The buying group of which T is a member negotiated a deal with a producer of a retail computer system. The system assists retail operators in a number of ways, including keeping track of inventory, measuring sales, assisting in the purchasing of merchandise and monitoring staff performance.

The buying group examined the hardware, software and prices associated with the retail system and negotiated a deal with the vendor on behalf of the buying group members. Under the agreement, the cost of implementation for T would have been about $25 000. The cost of the system, while not the major deterrent, clearly

caused B to more carefully consider the costs and benefits associated with the system.

The Reasons for Not Proceeding

Although the $25 000 pricetag was a concern, the fact that T's owner did not know the vendor of the system played a major role in his apprehension regarding the system's potential value. Not having a high level of computer literacy, T was reluctant to place himself at the 'mercy' of an unknown vendor. The owner felt that the designer–implementer of the system "could ask for more money or be apathetic regarding delays in the implementation timetable," particularly given T's lack of system familiarity. The owner felt quite uncomfortable with this situation. The owner was obviously quite busy in running his business, far too busy to "become a computer whiz"; yet he believed it was important that he feel very confident in the system installer prior to making a purchase decision.

In considering the purchase, T spoke with other retailers who had implemented systems. His general findings were that the running of parallel manual and computerized systems for up to one year was not unusual. This increased T's apprehension because he did not have the available resources to run parallel systems for such a long period. These discussions also revealed various horror stories regarding lost data, crashed systems, power failures and defective disks. These stories also introduced the requirement for the additional time and effort associated with back-up systems.

Perhaps the main reason for not proceeding with the retail system purchase a few years ago concerned the state of T's manual system. The owner felt at the time, as he continues to feel, that the manual system must be running very smoothly before attempting to implement a computer system. Failure to observe this general rule would potentially lead to a disastrous system implementation. At the time, T felt that his manual system was not sufficiently organized to lend itself to computerization, and he therefore opted to first upgrade the status of his manual system.

Subsequent Activities

Some time after having analyzed the retail system, T was approached by his accountant with an offer to install a system to improve the firm's record-keeping and accounting capabilities. Company T had a long association with the accountant, the feeling of trust existed to a greater degree than with other vendors with whom he had discussions, and the owner agreed to this offer. The accountant, in conjunction with a systems professional, designed a workable system. The owner is still not familiar with the terminology or technical workings of the system and has hired an employee to handle the computerized accounting function for the firm.

The owner still feels a lack of independence with regard to the installed system — he is at the mercy of his systems employee and his outside accountant–system implementer on matters intrinsic to the operating of the store. In retrospect, he would have installed more of a 'garden variety' software package rather than the complicated customized system, since he feels that such a system would have given him more independence.

Conclusion

This manager was inhibited by his lack of knowledge about new technologies and was looking, as a consequence, for a vendor that inspired trust and could provide considerable support throughout the process. In spite of the availability of an approved system, the owner need the comfort of a vendor that was close by and on call.

Bibliography

Canada. Economic Council of Canada. *Making Technology Work: Innovations and Jobs in Canada*. Ottawa, 1987.

Canada. Economic Council of Canada. *Working with Technology*. Ottawa, 1986.

Canada. Statistics Canada. *Survey of Manufacturing Technology*. Classification Systems Branch. Ottawa, October 1987.

Science Council of British Columbia and the Ministry of State for Science and Technology. *Advanced Forestry Technology Forum*. Report by the Canadian Advanced Technology Association, June 1987.

Ontario. *Competing in the New Global Economy*. Report of the Premier's Council. Toronto, 1988.

Ontario. Ministry of Skills Development. *The Role of Skills Training in the Process of Technology Diffusion in Ontario*. Toronto, 1987.

Ontario. Ministry of Industry, Trade and Technology. *Technology Transfer in Ontario*. Toronto, January 1986.

UK. Department of Trade and Industry. "Winning with IT." *Case Studies on the Application of Information Technology*. Organization and System Innovations Limited, 1987.

Datamation. *Industry by Industry Technology Forecast*. Staff Report. 15 January 1988.

Arnold, Erik and Ken Guy. *Information Technology and Emerging Growth Areas*. OECD Directorate for Science, Technology and Industry, August 1987.

Bertin, Oliver. "It's Gadgets Galore to Tempt Funseekers." *Globe and Mail*, 16 November 1987.

Burgleman, Bob. *Inside Corporate Innovation*.

Daubney, David. "Managing Information Technology." *Policy Options*, January 1988.

Gellman, Harvey. "Just Throwing in Tools Will Not Hit the Spot." *Globe and Mail*, 16 November 1987.

Gerstein, Marc. *The Technology Connection*. Addison-Wesley Publishers, 1987.

Litvak, Isaiah and Timothey Warner. "Multinationals, Advanced Manufacturing Technologies, and Canadian Public Policy." *Business Quarterly*, Summer 1987.

McLaughlin, Paul. "Machine Schemes." *Canadian Business*, January 1988.

Schultz, Randall et al. "Strategy and Tactics in a Process Model of Project Implementation." *Interfaces*, May-June 1987.

Wilson, Diane D. *Assessing I.T. Performance: What the Experts Say.* Working Paper — Management in the 1990's. Massachusetts Institute of Technology, Sloane School of Management, June 1988.

Technology and Employment: Innovation and Growth in the U.S. Economy. National Academy Press, 1987.